FOR CONSULTATION ONLY

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THE FAUNA OF BRITISH INDIA,

INCLUDING

CEYLON AND BURMA.

Published under the authority of the Secretary of State for India in Council.

EDITED BY W. T. BLANFORD.

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MAMMALIA.

BY

W. T. BLANFORD, F.R.S.

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INTRODUCTION.

THE present is the first part of a general work, compiled for the Government, and published under its authority, on the Fauna of British India and its dependencies. A few details respecting this larger work may serve as a preface to the introductory observations on the Mammalia.

The large additions made to our knowledge of Indian Zoology during the period, now about a quarter of a century, that has elapsed since the appearance of Jerdon's 'Birds' and 'Mammals' and Günther's 'Reptiles' have for some time rendered it desirable that a new series of descriptive manuals should be prepared. The Secretary of State for India in Council, upon the recommendation of the Government of India, gave his sanction, in 1883, to a plan for the preparation of the works most urgently required, and entrusted the editorship of the series to the present writer. From various causes the appearance of the work has been delayed, but it is hoped that the principal difficulties have now been overcome.

For the present, it is proposed to restrict the publication to the Vertebrata, and to complete the work in seven volumes of about 500 pages each. One of these volumes will contain the Mammals (the present issue is only a half-volume), three will be required for the Birds, one for Reptiles and Batrachians, and two for Fishes.

The authorship of the volumes on Fishes has been undertaken by Mr. F. Day, C.I.E., Deputy Surgeon-General, author of the 'Fishes of India'; the Reptilia and Batrachia will be described by Mr. G. A. Boulenger, author of the recently published British-Museum Catalogues of Batrachia and Lizards; whilst the Birds will, it is hoped, be taken in hand by Mr. E. W. Oates, author of the 'Birds of British Burmah.' The Mammals remain to be

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described by the Editor. The greater part of the second half-volume on Mammalia is written, and much progress has been made with all other parts of the work, so that there is every prospect of the whole being issued in the course of the next few years.

The limits adopted for the fauna are those of the dependencies of India, with the addition of Ceylon, which, although British, is not under the Indian Government. Within the limits thus defined are comprised all India proper and the Himalayas, the Punjab, Sind, Baluchistan, all the Kashmir territories, with Gilgit, Ladák, &c., Nepal, Sikhim, Bhutan, and other Cis-Himalayan States, Assam, the countries between Assam and Burma, such as the Khási and Naga hills and Manipur, the whole of Burma, with Karennee and, of course, Tenasserim and the Mergui Archipelago, and, lastly, the Andaman and Nicobar Islands. Afghanistan, Kashgaria, Tibet, Yunnan, Siam, and the Malay Peninsula south of Tenasserim are excluded. A few States, such as Nepal and Bhutan, at present not accessible to Europeans, are comprised, because it would be difficult to leave them out; scarcely an animal occurs in either not found also in British territories or in protected States, such as Sikhim.

The whole of India and its dependencies, with the exception of the higher Himalayas and Trans-Himalayan tracts, is included in the Oriental Region, one of the six great zoological regions* into which the terrestrial surface of the globe was divided by Sclater, whose views have been adopted by Wallace and others. Several Ethiopian and Palæarctic genera are intermixed with forms characteristic of the Oriental Region in North-western India, and some of these forms range throughout the Peninsula, but not further to the eastward.

The division of the area into zoological subregions is somewhat difficult, the affinities of the different subdivisions being compli-

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* These six zoological regions are the following :—

I. *Palæarctic*: Europe, Africa north of the Sahara, and Asia north of the Himalayas.

II. *Ethiopian*: Africa south of the Sahara.

III. *Oriental*: India and South-eastern Asia, with the Malay Archipelago, as far east as Java, Bali, Borneo, and the Philippines.

IV. *Australian*: Australia, Celebes, New Guinea, New Zealand, and the islands of the Pacific.

V. *Nearctic*: America north of the Tropic of Cancer.

VI. *Neotropical*: Central and South America.

For further particulars, see Wallace's 'Geographical Distribution of Animals.'

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cated. The following subregions may be accepted as convenient and as approximately correct:—

I. *Tibetan.* The Upper Indus valley (Gilgit, Ladák, &c.) and the higher Himalaya above 12,000 or 14,000 feet.

II. *Himalayan.* The southern slopes of the Himalaya, from the base to about the limit of trees.

III. *Indian.* India from the base of the Himalaya to Cape Comorin, with the exception of the Malabar coast, but with the addition of Northern Ceylon.

IV. *Malabar or Ceylonese.* The Malabar coast and the neighbouring hills as far north as the Tapti river, together with Southern Ceylon.

V. *Burmese.* All Burma except South Tenasserim, and with the addition of Assam and the intervening countries.

VI. *South Tenasserim.* This is the northern extremity of the great Indo-Malayan subregion, comprising the Malay Peninsula and several of the islands.

Some of these may require further subdivision. Thus the fauna of the North-west Provinces and Punjab differs considerably from that of Southern India, and both areas exhibit zoological distinctions from the forest-clad tracts of South-western Bengal. There is also much difference between the animals of Pegu and Arakan, on the one hand, and those of the drier regions of Upper Burma on the other; and even greater distinctions may be traced between those found in the subtropical and those inhabiting the temperate regions of the Himalaya. On the other hand, the subtropical Himalayas were united with the Burmese subregion by Wallace, and the two are, perhaps, zoologically more allied to each other than to any other subregion.

It is well to notice that the Tibetan subregion is Palæarctic, whilst the other five subdivisions are included in the Oriental Region.

The preceding remarks apply to the 'Fauna of British India' in general; the following relate to the present volume. The classification of Mammals here adopted was proposed by Professor Flower in the Proceedings of the Zoological Society of London for 1883, pp. 178–186. The arrangement is but slightly modified from that employed by the same author in the last (ninth) edition of the 'Encyclopædia Britannica' (Article "Mammalia"). Although this classification is, so far as I am able to judge, the best hitherto published, there are, as will be mentioned in the proper places, several questions on which wide differences of opinion exist. Thus many excellent naturalists regard as of ordinal rank subdivisions such as, for instance, the *Lemuroidea* and *Proboscidea*, classed by Professor Flower as suborders.

The descriptions of the genera and species in the following pages have been taken from specimens, whenever any were accessible; in the few cases in which, for want of available specimens, the characters are copied from descriptions by previous writers, the fact is stated. The measurements are taken from various sources, and, whenever possible, dimensions of freshly-killed animals, or, in the case of the smaller forms, of perfect examples preserved in spirit, have been selected. The length of the head and body from the tip of the nose to the insertion of the tail and the length of the tail are naturally of little value when taken from skins; these two dimensions are given, when possible, in the following pages, the tail measurement being without the hair, if data are available. Other measurements often cited are those of the ear, usually from the crown of the head, sometimes from the external base or from the orifice, and of the pes or hind foot, including the tarsus, from the joint corresponding to the heel in man and the hock in a horse to the end of the longest toe, the claws not being included, unless their inclusion is specified. In particular cases other dimensions are added, for instance the forearm in bats.

Two measurements of the skull are generally given:—the basal length, from the anterior or lower margin of the foramen magnum to the anterior border of the premaxillaries, the incisor teeth not being included; and the zygomatic breadth, across the widest part of the zygomatic arches. The extreme length of the skull sometimes recorded is either from the posterior surface or from the supraoccipital to the end of the premaxillaries, or, in some skulls, to the end of the nasals.

The notes on distribution and habits are compiled from various writers, especially from the works of Jerdon, Blyth, Hodgson (inclusive of the MS. notes on his drawings in the Zoological Society's library), Elliot, Kelaart, Tickell (also including his MS. notes), Sterndale, McMaster, Forsyth, Sanderson, and others, supplemented by my own observations during a residence of more than 20 years in India, in the course of which time, whilst employed in the Geological Survey of the country, I visited many parts of India and Burma, and became acquainted with most of the wild animals in their native haunts.

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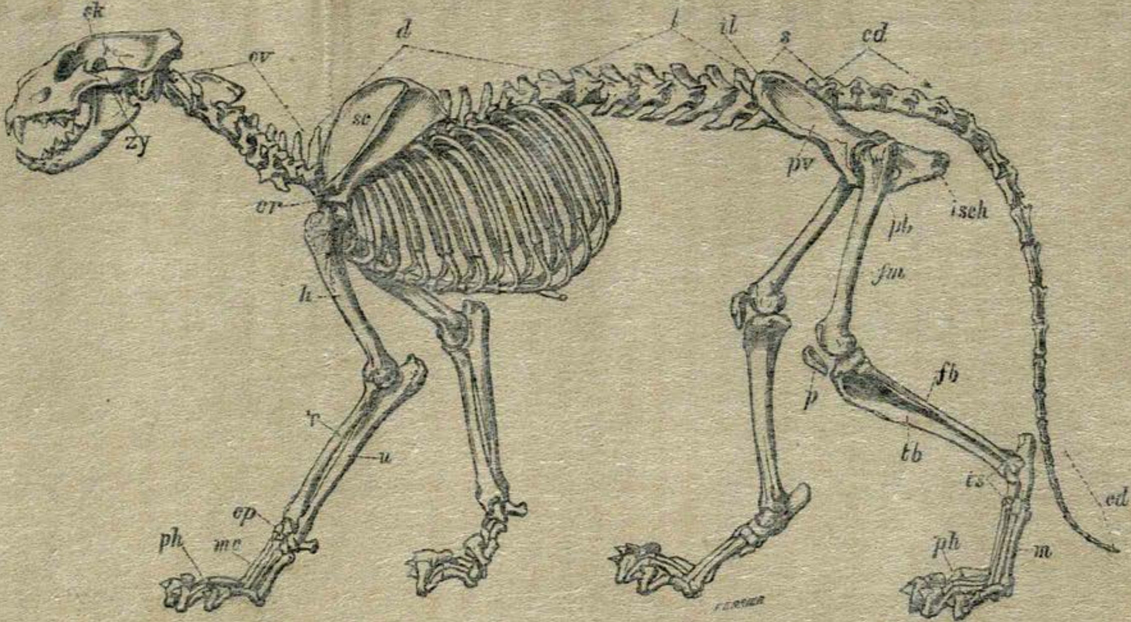
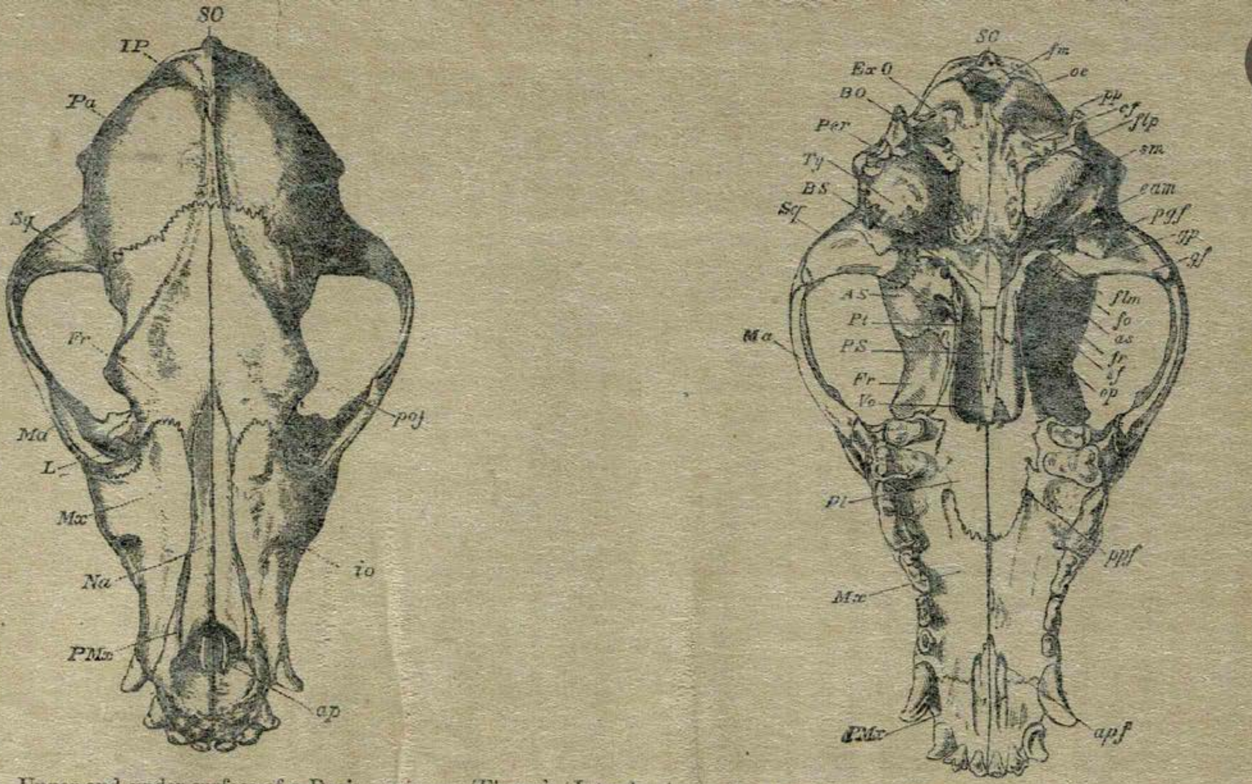


Skeleton of a Lioness. (From Guide to the Galleries of Mammalia, British Museum.)

cd, caudal vertebræ; *cp*, carpus; *cr*, coracoid; *cv*, cervical vertebræ; *d*, dorsal vertebræ; *fb*, fibula; *fm*, femur; *h*, humerus; *il*, ilium; *isch*, ischium; *l*, lumbar vertebræ; *m*, metatarsus; *mc*, metacarpus; *p*, patella; *pb*, pubis; *ph*, phalanges; *pv*, pelvis; *r*, radius; *s*, sacral vertebræ; *sc*, scapula; *sk*, skull; *tb*, tibia; *ts*, tarsus; *u*, ulna; *zy*, zygomatic arch.



Upper and under surface of a Dog's cranium. (Flower's 'Introduction to the Osteology of the Mammalia,' figs. 46, 47.)

ap, *apf*, anterior palatine foramen; *AS*, alisphenoid; *as*, posterior opening of alisphenoid canal; *BO*, basioccipital; *BS*, basisphenoid; *cf*, condylar foramen; *eam*, external auditory meatus; *ExO*, exoccipital; *flm*, foramen lacerum medium; *flp*, foramen lacerum posterius; *fm*, foramen magnum; *fo*, foramen ovale; *Fr*, frontal; *fr*, foramen rotundum and anterior opening of alisphenoid canal; *gf*, glenoid fossa; *gp*, postglenoid process; *io*, infraorbital foramen; *IP*, interparietal; *L*, lachrymal; *Ma*, malar or jugal; *Mx*, maxilla; *Na*, nasal; *oc*, occipital condyle; *op*, optic foramen; *Pa*, parietal; *Per*, mastoid portion of periotic; *pgf*, postglenoid foramen; *Pl*, palatine; *PMx*, premaxilla; *pof*, postorbital process of frontal bone; *pp*, paroccipital process; *ppf*, posterior palatine foramen; *PS*, presphenoid; *Pt*, pterygoid (the mesopterygoid fossa is the hollow between the two pterygoid bones); *sf*, sphenoidal fissure or foramen lacerum anterius; *sm*, stylo-mastoid foramen; *SO*, supra-occipital; *Sq*, squamosal and its zygomatic process; *Ty*, tympanic or auditory bulla; *Vo*, vomer.

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The synonymy has been thoroughly revised, the original descriptions having been consulted in every case. A list of the principal works quoted, with their abbreviated titles, is appended. The British-Museum catalogues by Dr. Gray are referred to as seldom as possible, because of their inaccuracy. A considerable proportion of the mistakes made by Indian naturalists, in nomenclature especially, may be traced to these catalogues.

Space does not permit the addition of a sketch of mammalian anatomy. The accompanying woodcuts of a lion's skeleton and of a dog's skull will suffice to show the names and position of the principal bones. For further details with regard to the skeleton the student will do well to consult Flower's 'Introduction to the Osteology of the Mammalia,' from which, by permission of the author and publishers, the woodcuts of a dog's skull are taken. For the anatomy of the soft parts no similar compendium exists; a sketch will be found in the article "Mammalia" in the 'Encyclopædia Britannica,' but a general work on mammalian anatomy is still wanted. The teeth have been treated in separate works by Owen, Giebel, and others. Here it is only necessary to say that they are divided into incisors, canines, premolars, and molars; that the three first-named are, as a rule, preceded in the young mammal by milk or deciduous teeth; that the upper canine is the tooth behind the premaxillary suture or in contact with it, and the lower canine the tooth that, when the jaws are closed, comes immediately in front of the upper canine; the teeth in front of the canines are incisors, those behind premolars and molars.

It will be difficult within the limited space available for me to acknowledge the assistance of all who have aided me in preparing the present work. I am indebted particularly to General R. Strachey and Col. Yule, and equally so to Professor Flower and Dr. Günther for aid most liberally given on all occasions, also to Mr. P. L. Sclater, Dr. J. Anderson, Sir J. Fayrer, Prof. A. Newton, Mr. A. Hume, Prof. Mivart, Mr. J. Scully, Sir O. B. St. John, Col. J. Biddulph, Mr. Davison, Captain Bingham, Mr. W. Daly, Rev. S. Fairbank, Mr. Wood Mason, Mr. W. L. Sclater, Mr. H. E. Watson, the late Mr. L. Mandelli, and Mr. J. Murray, for assistance of various kinds. Above all I am under obligations to Mr. G. E. Dobson and Mr. Oldfield Thomas, not merely for the great extent to which this work has been facilitated by their writings, but also for advice and information of many kinds and on numerous occasions. But for Mr. Dobson's researches amongst the Chiroptera and Insectivora, the labour of preparing a work on Indian Mammalia would have been greater by at least one third.

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I have also to acknowledge with gratitude the permission liberally granted to me by the Trustees of the British Museum, the Zoological Society, Messrs. Macmillan and Co., and Messrs. Black and Co., of Edinburgh, to publish copies of woodcuts taken from their publications. The work from which the cut is taken is quoted in each case. Several of the illustrations are, by permission of the Zoological Society, taken from drawings by the late Col. Tickell, and from the superb collection made by Mr. B. H. Hodgson, both of which series are now in the Society's Library. The majority of the cuts are copied, from drawings by Mr. R. E. Holding and Mr. P. J. Smit, by the Typographic Etching Company's process.

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Temminck, Mon. Mam. Monographies de Mammalogie. Par C. J. Temminck. Paris, 1827–1841.

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Zimm. Geog. Gesch. Geographische Geschichte der Menschen und der allgemein verbreiteten vierfüssigen Thiere, von E. A. W. Zimmermann. Leipzig, 1778.

MAMMALIA.

Mammals are warm-blooded Vertebrate animals that nourish their young with milk secreted by the females in glands situated in pairs on the under surface of the body. All, with a very few exceptions (chiefly *Cetacea*), are covered with hair. The great majority possess teeth, and the higher forms are heterodont, or furnished with teeth of different kinds, and diphyodont, or bearing two sets—the first, known as milk or deciduous teeth, generally coming into use at birth or soon after, and being subsequently replaced by a second or permanent set. Most mammals possess two pairs of limbs like other normal vertebrates, and the terminal extremities of these limbs, with but few exceptions, are furnished with nails, claws, or hoofs. The thoracic cavity, containing the lungs, is completely separated by the diaphragm from the abdomen.

The class Mammalia is divided into the following *subclasses* :—

A. Oviparous, both genito-urinary passage and anus opening into a cloaca.

I. **PROTOTHERIA, Ornithodelphia** or **Monotremata.**

B. Viviparous, genito-urinary orifice external and distinct from anal[*].

a. No allantoid placenta[†].

II. **METATHERIA, Didelphia** or **Marsupialia.**

b. An allantoid placenta.

III. **EUTHERIA, Monodelphia** or **Placentalia.**

Of the subclasses the *Prototheria* or *Monotremata* are peculiar to the Australian region, whilst the *Metatheria* or *Marsupialia* are only found in the same region and in America (chiefly in South America). The *Eutheria* or *Placentalia* comprise, according to Professor Flower's latest classification, nine orders, all represented in India. These orders may be distinguished (so far, at all events, as Indian genera are concerned) by the characters shown in the following table: these characters are not always those of the greatest importance, but only those most easily recognized:—

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[*] The two open on a common outlet in some genera of *Insectivora*.

[†] For full details as to the significance of these characters in classification, consult Huxley's 'Introduction to the Classification of Animals,' p. 87, or Balfour's 'Comparative Embryology,' vol. ii. p. 176, or 'Encyclopædia Britannica,' article "Mammalia," pp. 369, 371, &c.

Subclass EUTHERIA.

- A. Posterior limbs present.
  - *a*. Animal not modified for flight.
    - a'. Incisors present in one or both jaws.
      - a''. Incisors in front of the upper and lower jaw, either not two in number or not chisel-shaped.
        - a^3. Feet terminating in distinct toes with claws or nails.
          - a^4. Hallux or pollex or both opposable to other digits . 1. *PRIMATES.*
          - b^4. Neither hallux nor pollex opposable.
            - *aa*. Upper lip in general not projecting far beyond lower; median pair smaller than other incisors . . . . 2. *CARNIVORA.*
            - *bb*. Snout very pointed: upper lip projecting far beyond lower; median pair of incisors generally larger than the others . . . . 3. *INSECTIVORA.*
        - b^3. Feet either not terminating in distinct toes or furnished with hoofs or hoof-shaped nails . . . . 6. *UNGULATA.*
      - b''. Two chisel-shaped incisors in front of each jaw . . . . 5. *RODENTIA.*
    - b'. No incisors, except in certain Armadillos; Indian forms toothless . . . . 9. *EDENTATA.*
  - *b*. Animal modified for flight; fingers enormously developed to support a membranous wing . . . . 4. *CHIROPTERA.*
- B. No external posterior limbs; body modified for swimming.
  - *a*. Homodont or toothless: breathing-orifice generally on top of head; a back fin in most genera; mammæ inguinal . . . . 7. *CETACEA.*
  - *b*. Indian form heterodont: breathing-orifice at end of muzzle; no back fin; mammæ pectoral . . . . 8. *SIRENIA.*

Order PRIMATES.

This Order comprises Man, Monkeys, and Lemurs, and therefore includes the most highly organized Mammalia. At the same time the Lemurs and some of the Monkeys are of comparatively low grade, and much inferior, at all events in development of brain, to Mammalia belonging to other orders.

The dentition throughout the order is heterodont (comprising incisors, canines, premolars, and molars) and diphyodont. There is a bony ring to the orbit, the clavicles are well developed, and the radius and ulna are distinct. There are usually 5 unguiculate digits to both the manus and pes, but the pollex may be rudimentary or wanting. Either the pollex (thumb) or hallux (great toe) or both are opposable.

The members of this division are almost without exception arboreal.

The Primates are divided into two suborders. Many naturalists class the Lemurs as a distinct order, for reasons that will be noticed under *Lemuroidea*.

The suborders are thus distinguished :—

A. Orbit completely enclosed by bone behind. Pollex (or thumb) short (wanting in a few instances); second digit of foot with a nail similar to those of other digits. Upper incisors not divided by a space in the middle.. ANTHROPOIDEA.

B. Orbit opening behind into temporal fossa beneath the postorbital arch. Pollex long, second digit with a long claw. Upper incisors (except in *Chiromys*) divided by a space in the middle .... LEMUROIDEA.

Suborder *ANTHROPOIDEA*.

A. Premolars $\frac{2}{2}$, molars $\frac{3}{3}$; thumb, if present, opposable; internasal septum narrow. (*Catarrhini.*)

I. No tail; stature erect; great toe or hallux parallel with other toes, not opposable; arm shorter than leg; no interval between upper canines and incisors; canines not longer than incisors .... **Hominidæ.**

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II. No tail; stature sometimes erect, sometimes not; hallux opposable; arm longer than leg; an interval between upper canines and incisors; canines in adults longer than incisors .... **Simiidæ.**

III. A tail almost always present; stature never erect; hallux opposable; arm not longer than leg; an interval between upper canines and incisors; canines in adults longer than incisors .... **Cercopithecidæ.**

B. Premolars $\frac{3}{3}$, molars $\frac{2}{2}$ or $\frac{3}{3}$; thumb not opposable; hallux always opposable; internasal septum broad. (*Platyrrhini*, all American.)

IV. M. $\frac{3}{3}$; tail in many cases prehensile .... **Cebidæ.**

V. M. $\frac{2}{2}$; tail not prehensile .... **Hapalidæ.**

The family *Hominidæ* comprises but one genus, and, according to the views usually accepted, but one species, Man. Naturalists have differed as to the physical relations of Man to other animals, but most modern writers have returned to the views of Linnæus, and class Man with the Monkeys, but in a distinct family*. No attempt will be made in the present work to enter into the anthropology of India; the subject requires a volume to itself.

The *Cebidæ* and *Hapalidæ* are confined to America. Representatives of the *Simiidæ* and *Cercopithecidæ* are found within the Indian area.

Family SIMIIDÆ.

The *Simiidæ*, or anthropoid Apes, comprise the Gorilla, Chimpanzee, Orang-outang, and Gibbons. The first two are peculiar to Africa, the Orang-outang inhabits Sumatra and Borneo, whilst the Gibbons, forming the genus *Hylobates*, are found throughout South-eastern Asia and some of the neighbouring islands, but not west of the Bay of Bengal. They are the only members of the family occurring within our area.

In Pliocene times, however, it is probable that two large anthropoid Apes inhabited Northern India. One of these, *Troglodytes sivalensis*, was allied to the Chimpanzee, whilst a canine tooth indicates a form very closely approaching the Orang-outang. Remains of both have been found in the Siwalik beds of the Punjab.

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* On this subject the following works may be consulted:—Darwin, 'The Descent of Man;' Huxley, 'Man's Place in Nature;' Mivart, under the article "Ape," and Flower, under "Mammalia," in the 'Encyclopædia Britannica,' 9th edit.

Genus **HYLOBATES**, Illiger (1811).

Size smaller than that of other anthropoid Apes; the largest species, *H. syndactylus*, not much exceeding three feet in height. Body and limbs slender; arms, hands, and feet exceedingly long, the arms being so much longer than the legs that the hands reach the ground when these animals stand upright on their feet—a position that is assumed habitually by this genus, and by this alone, amongst the *Simiidæ*, when walking. Thumb and great toe deeply separated from the next digits. Ischial callosities (naked thickened skin on each buttock) present, but small. There are generally 13 pairs of ribs, 5 lumbar, 3 sacral, and 3 or 4 caudal (coccygeal) vertebræ; so that there being, as usual, 7 cervical vertebræ, the vertebral formula is C. 7, D. 13, L. 5, S. 3, C. 3–4.

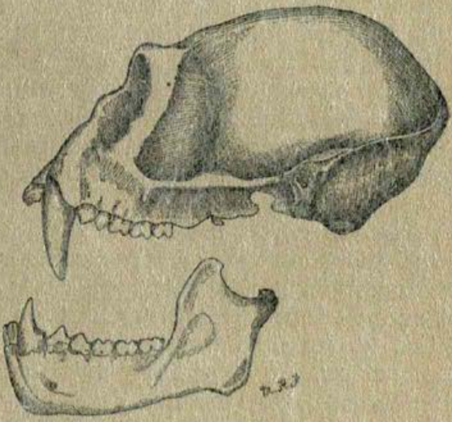

Fig. 1.—Skull of *Hylobates lar*.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$.

Synopsis of Indian and Burmese Species.

A white or grey band across the eyebrows, remainder of head and upper surface of feet and hands the same colour as the body	*H. hoolock*, p. 5.
Hands, feet, and a ring of hair surrounding the face white or whitish	*H. lar*, p. 7.

1. **Hylobates hoolock.** *The Hoolock* or *white-browed Gibbon.*

Simia hoolock, *Harlan, Trans. Am. Phil. Soc.* iv, p. 52, pl. 2 (1834).
Hylobates hoolock, *Blyth, Cat.* p. 4; *Sclater, P. Z. S.* 1870, pl. v, fig. 2; *Blyth, Mam. Birds Burma*, p. 1; *Anderson, An. Zool. Res.* p. 1; *id. Cat.* p. 26.

Uluk, Hindi; *Myouk-lwai-gyau* and *Tuboung*, Burmese of Arakan.

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Colour. Generally black throughout, with the exception of a white or grey band across the eyebrows. This band is usually, but not always, interrupted in the middle. Many individuals, however, both males and females, vary in colour from brownish black to light yellowish grey, the frontal band being always conspicuously paler. The crown, back, and outside of the limbs are often paler-coloured than the lower parts of the body, the skin of the naked part of the face below the frontal band being almost always dark-coloured. Blyth thought that the males only were black, the females always paler; but this is certainly not the case; the females, however, are more frequently pale-coloured than the males.

Dimensions. From crown to rump about 20 inches, fore limb (including hand) 23, hand alone 6, leg and foot 19, foot 6; height from crown to heel about 32 inches. An adult male skull is 4·45 inches long from the occiput to the alveolar margin of the premaxillaries at the base of the middle upper incisors, 3·35 in basal length from the lower or anterior edge of the foramen magnum to the same, and 2·9 in breadth across the widest part of the zygomatic arches.

Distribution. The hill-ranges south of Assam; Sylhet, Cachar, Manipur, Irawadi valley near Bhamo, Chittagong, and Arakan in hill-forest. It is uncertain how far the species is found to the eastward. According to Anderson it inhabits Martaban. Pemberton's assertion that this species occurs at the base of the Himalayas in the lower ranges of Bhutan is probably a mistake. The type described by Dr. Harlan came from the Garo hills.

Habits. Good accounts of this animal are given by Burrough, in Harlan's original description, by Blyth and by Anderson. Like most other Gibbons, the Hoolock is usually found associating in flocks, often comprising fifty to a hundred individuals, or even more. An old male, however, is occasionally found solitary.

Gibbons are thoroughly arboreal, and Hoolocks are almost, if not entirely, confined to hill-forest. They move chiefly by means of their long arms, by which they swing themselves for prodigious distances from branch to branch and from tree to tree. They descend hill-sides at a surprising pace, their descent being accomplished by grasping bamboos or branches that bend beneath their weight, and allow them to drop until they can seize the ends of other bamboos or branches lower on the slope, and take another mighty swing downwards. They also ascend with great rapidity, swinging themselves from tree to tree.

When walking on the ground, the Hoolock rests on its hind feet alone, with the sole flat on the ground and the great toe widely separated from the other digits. The arms are usually held upwards, sometimes horizontally, their great length giving the animal a very peculiar aspect. Gibbons walk rather quickly, with a waddling gait, and can easily be overtaken by men when on the ground.

The food of these Apes consists of fruit, leaves, young shoots, spiders (of which they are very fond), insects, birds' eggs, and

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almost certainly of young birds, if not of any birds they can capture. Anderson found that small birds were killed and devoured by Hoolocks in confinement with a method and eagerness that showed the prey to be the natural food of the Apes*. The Hoolock drinks with its lips, putting its head down to the water as monkeys do.

All species of *Hylobates* have a powerful voice, and the common name of the present form is taken from its peculiar double call, which is repeated several times. At a distance, the sound much resembles a human voice; it is a peculiar wailing note, audible from afar, and in the countries inhabited by these animals is one of the most familiar forest sounds. The calls commence at day-break, and are continued till 9 or 10 A.M., several of the flock joining in the cry, like hounds giving tongue. After 9 or 10 o'clock in the morning the animals feed or rest, and remain silent throughout the middle of the day, but recommence calling towards evening, though to a less extent than in the earlier part of the day.

When captured young the Hoolock is easily tamed, and is, as a general rule, very gentle, docile, and good-tempered, exceedingly intelligent, and very cleanly in its habits. Some instances of savageness on the part of male animals have, however, been noticed. All the Gibbons are very delicate, and rarely live long in captivity.

But a single young is born at a time. Neither the period of gestation nor the age at which these animals become adult appears to have been ascertained.

2. **Hylobates lar.** *The white-handed Gibbon.*

Homo lar, *L. Mantissa*, App. p. 521 (1771).

Hylobates lar, *Illiger*, *Prod.* p. 68 (1811); *Blyth*, *Cat.* p. 5; *id. Mam. Birds Burma*, p. 1; *Tickell*, *J. A. S. B.* xxxiii, p. 196; *Sclater*, *P. Z. S.* 1870, pl. v, f. 1; *Anderson*, *An. Zool. Res.* p. 5; *id. Cat.* p. 28.

Myouk-lwai-gyau, Burmese; *Ungka étam*, Malay.

The skull is shorter in proportion to its length than that of *H. hoolock*. The orbital ridges in *H. lar* are more prominent, the muzzle shorter, the nasal orifice less elongated, the teeth smaller, and the palate shorter.

Colour. Black to fulvous or yellowish white, the back sometimes lighter than the lower parts, occasionally much variegated. Hands and feet always pale-coloured, usually white or yellowish white above. There is generally around the nude face a white ring of hair, comprising frontal band, whiskers, and beard; but the development of the ring varies, and in some specimens it is almost

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* The dexterity of an allied species, *H. agilis*, in capturing birds on the wing had previously been observed (Martin, 'Man and Monkeys,' p. 430).

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obsolete. Naked skin of the face black. According to all accounts, this species is much more variable in colour than *H. hoolock*, and pale-coloured specimens are far commoner, in some localities predominating.

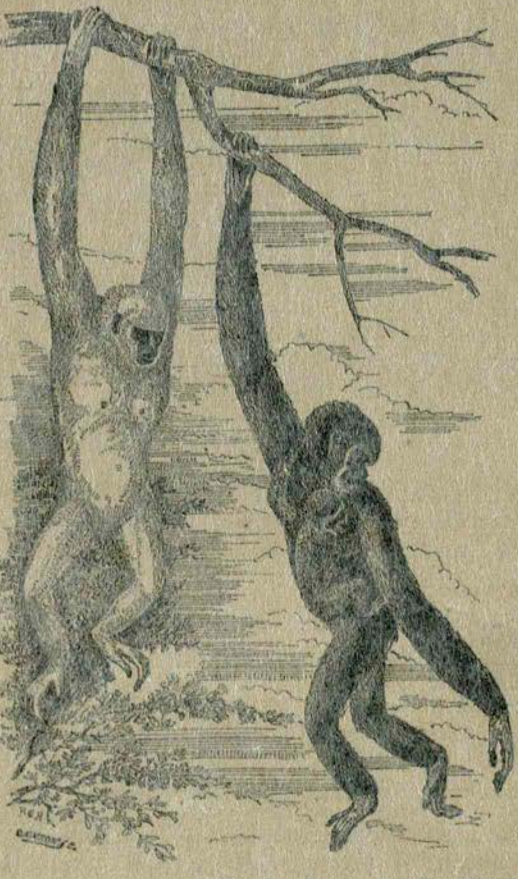

Fig. 2.—*Hylobates lar*. (From a drawing by Col. Tickell.)

Dimensions. An adult male, according to Tickell, measures from crown to rump 19·6 inches, fore limb 25 (humerus 9·5, radius 9·5, hand 6), hind limb 19·5 (femur 7·5, tibia 7·5, foot 4·5). The height, when standing erect, is about 30 inches; some are said to be larger. Females are smaller than males. An adult skull is 4·15 inches long from the occiput, 3·05 from the foramen magnum, 2·95 broad.

Distribution. The white-handed Gibbon is found in Tenasserim in the forests skirting the hills up to an elevation of 3000 or 3500 feet above the sea, and throughout the Malayan peninsula. Tickell says that it ranges as far north as the northern limit of Pegu, but not west of the dividing range between Pegu and Arakan; whilst Anderson states that it is found both in Arakan and Lower Pegu. I doubt the occurrence of this species in the latter countries, and I can find no satisfactory evidence of its existence in the Irawady or Sittoung valleys, although it very probably inhabits the hills east of the Sittoung. Further information as to the range of *H. lar* and *H. hoolock* in Burma is desirable.

Habits. The white-handed Gibbon is said by Tickell, who observed both species in their native forests as well as in captivity, not to be nearly so light and active as the Hoolock, and to walk less readily. The voice, too, is quite distinct, according to the same observer, in the two species. The cry of *H. lar* has been rendered in musical notation by Tickell, who has given, in the paper quoted above, an admirable account of the animal's habits. It is usually found in parties of from 6 to 20, composed of individuals of all ages.

The present species is said to drink by scooping up water in its hand, and not as the Hoolock does. So entirely does it depend on its hands for locomotion amongst trees, that it carries anything in its feet. Tickell, from whom I take these details, says that he has seen a party of *H. lar* escape thus with their plunder from a Karen garden in the forest.

In all other respects the habits of this species, so far as they are known, resemble those of *H. hoolock*. The young, almost always one in number,—twins being as rare as amongst human beings,—are born in the early part of the cold season, and each sticks to the body of its mother for about seven months, after which it begins gradually to shift for itself.

According to Helfer (J. A. S. B. vii, p. 858), the Siamang (*Hylobates syndactylus*) is found in Southern Tenasserim; but several of Helfer's identifications were incorrect, and as no one has since heard of the animal in the Tenasserim provinces, I agree with Blyth in believing that Helfer must have been mistaken. The Siamang is larger than the other species of Gibbon, standing about 3 feet 2 inches in height, and is perfectly black in colour throughout. It is doubtful if the Siamang occurs elsewhere than in Sumatra, though Wallace states that it is found in the Malay Peninsula, where the only species, except *H. lar*, noted by Cantor (J. A. S. B. xv, p. 173) is *H. agilis*. In Siam *H. leucogenys* (figured P. Z. S. 1877, pl. lxx) is said to occur.

At the same time there appears to be a large, not yet identified, Ape in the mountains of Tenasserim, but whether it belongs to the anthropoid Apes, or is a large tailless or nearly tailless *Macacus*, it is impossible to say. The only observers who have seen this animal, so far as I am aware, are Mr. W. Davison and Captain C. F. Bingham. The former writes to me that when collecting birds for Mr. Hume, on Muleyit, a mountain about 7000 feet high, east of Moulmain, he came suddenly on a number of Monkeys feeding on the ground in a very dense part of the forest. He had a good look at one standing erect about 10 feet away, and considered it too large for a *Hylobates*, as its height was about 4 feet. It was, in front, of a deep ferruginous colour, and as it moved away it was distinctly seen to be tailless. Mr. Davison does not remember the colour of the back, but thinks it was the same as that of the underparts. He had only a half-charge of the smallest shot in his gun, so did not fire, and he never saw any of these animals again.

Captain Bingham informs me that a specimen was brought to him in the flesh (but unfortunately so decomposed that only the skeleton could be preserved) of a tailless female Ape, with long grizzled red hair on the outside of the limbs, and standing about 3 feet 6 inches high. This was near the place, Muleyit, where the animals above mentioned were seen by Mr. Davison. The skeleton was subsequently lost or mislaid. The same observer once saw a party of four or five large tailless monkeys at the foot of Muleyit, but these appeared to be black in colour. None of the animals resembled Gibbons.

Both Mr. Davison and Captain Bingham are excellent observers. The only known animal corresponding with their descriptions is the Ourang-outang, but so well-known a form would have been recognized by others. It is perhaps more probable that the animal seen may have been a tailless, or nearly tailless, *Macacus*.

Family CERCOPITHECIDÆ.

This family comprises all the Old-World Apes, Monkeys, and Baboons, with the exception of the anthropoid Apes. It is divided into two subfamilies, both represented in India.

Cheek-pouches present, stomach simple, tail variable	*Cercopithecinæ.*
No cheek-pouches, stomach sacculated, tail always long	*Semnopithecinæ.*

Subfamily CERCOPITHECINÆ.

In this subfamily are included not only all the common Indian Monkeys except those belonging to the Hanumán or Langur group, but also the closely allied African forms belonging to the genera *Cercopithecus* and *Cercocebus*. The African Baboons (*Cynocephalus*), distinguished by having the nostrils quite at the end of the muzzle, are also included by many writers.

By Blyth, Jerdon, and others, the short-tailed Indian Monkeys were classed in the genus *Inuus*, the long-tailed Macaques in *Macacus*. But the type of Lacépède's original genus *Macaca*[*]

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[*] Mém. de l'Inst. iii. p. 490 (1801).

(subsequently modified by F. Cuvier and Desmarest into *Macacus*) and of *Inuus* of Cuvier was the same animal, the Magot or Barbary Ape (*Simia inuus*, L.).

The length of the tail is certainly, by itself, not a sufficient generic distinction amongst these monkeys, for there is a complete gradation from the tailless *M. inuus*, through the stump-tailed *M. arctoides*, to the pig-tailed *M. nemestrinus*, and thence to *M. rhesus*, which leads to the long-tailed Macaques. The most peculiar of the Indian forms is *M. silenus*, which has by some naturalists been made the type of a distinct genus, *Silenus*. Even in this case, however, the only difference of any importance, the presence of a ruff of long hair round the face, is scarcely of generic rank. In the present work, all the Indian, Burmese, and Ceylonese species are comprised under *Macacus*.

A species of *Macacus* and two of *Cynocephalus* (the latter, as already noticed, now peculiar to Africa) have been discovered fossil in the Pliocene Siwalik beds of the Punjab. A tooth of *Cynocephalus* has also been found in the Pleistocene deposits of the Kurnool caves.

Genus **MACACUS**, Lacépède (1801).

Syn. *Inuus*, Cuv.; *Silenus*, Gray.

Body and limbs stout, tail variable. Males larger than females and with larger canines. Ischial callosities well developed. Cheek-pouches large. Muzzle considerably produced; nostrils opening obliquely some distance short of the end of the muzzle. Last molar of lower jaw with five tubercles. Dentition, as throughout the family, i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Vertebral formula C. 7, D. 12 (occasionally 13), L. 7 (or 6), S. 3, C. 10–22.

The Macaques are much more compactly built than the *Semnopitheci*, and have shorter limbs and a considerably longer muzzle. The species of the present genus resemble each other in their habits; they are found in flocks, often of considerable size, and generally composed of both sexes and of all ages. They are active animals, though less rapid in their movements, whether on trees or on the ground, than the *Semnopitheci*. Their food is varied, most of the species, if not all, eating insects as well as seeds, fruits, &c., and one kind feeding partly on crustacea. They have occasionally been known to devour lizards, and, it is said, frogs also. All have the habit of cramming food into their cheek-pouches for mastication at leisure, a practice that must be familiar to any one who has fed monkeys in confinement.

The voice and gestures of all * the species are similar and differ entirely from those of both the Gibbons and *Semnopitheci*. Tickell notices this in his MS. notes, and gives the following details, which are worthy of extraction :—" Anger is generally silent, or, at most,

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* *M. silenus* may be an exception, as it is said to have a peculiar call. I have had no opportunities of observing this species in the wild state.

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expressed by a low hoarse monotone '*heu*,' not so gular or guttural as a growl. Ennui and a desire for company by a whining '*hom*.' Invitation, deprecation, entreaty, by a smacking of the lips and a

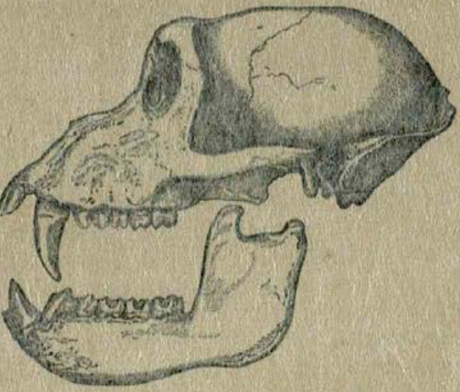

Fig. 3.—Skull of *Macacus rhesus*: ½ diam. (Copied from Anderson, 'An. Zool. Res.')

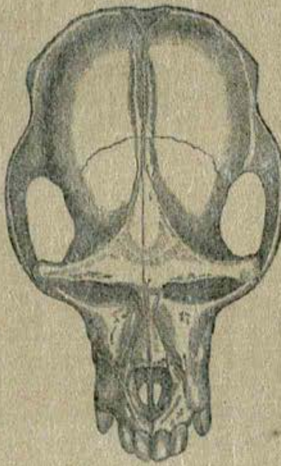

Fig. 4.—Skull of *Macacus rhesus*: ½ diam. (From Anderson.)

display of the incisors into a regular broad grin, accompanied with a subdued grunting chuckle, highly expressive, but not to be rendered on paper. Fear and alarm by a loud harsh shriek, '*kra*' or '*kraouk*,' which serves also as a warning to the others who may be heedless of danger. Unlike the *Presbytes* (*Semnopitheci*) and Gibbons, they have no voice if calling to one another."

The majority of the species are very docile when young. They thrive well, and several of them have bred in confinement. The

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period of gestation is about seven months, only a single young one, as a rule, being produced at a birth. They become adult at the age of 4 or 5 years, but breed earlier.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Tail less than $\frac{3}{4}$ of head and body together.
  a. Colour black, a grey beard and ruff round face .... *M. silenus*, p. 16.
  b. Colour brown, no beard or ruff.
    a′. Tail about half as long as the head and body.
      a″. Hair straight, buttocks naked around callosities .... *M. rhesus*, p. 13.
      b″. Hair wavy or woolly, buttocks clad up to edge of callosities .... *M. assamensis*, p. 15.
    b′. Tail about $\frac{1}{3}$ as long as the head and body, and very slender.
      a″. A distinct horseshoe-shaped crest on the crown .... *M. leoninus*, p. 18.
      b″. No distinct crest.................. *M. nemestrinus*, p. 20.
    c′. Tail very short, only one or two inches in length .... *M. arctoides*, p. 17.
B. Tail more than $\frac{3}{4}$ of head and body together.
  a. Hair of crown lengthened and distinctly radiating from middle.
    a′. General colour greyish brown, not rufous .... *M. sinicus*, p. 23.
    b′. General colour rufous or yellowish .... *M. pileatus*, p. 24.
  b. Hair of crown neither lengthened nor distinctly radiating .... *M. cynomolgus*, p. 21.

3. **Macacus rhesus.** *The Bengal Monkey.*

Simia rhesus, *Audebert, Hist. Nat. Singes*, 2^{e} fam. p. 5, pl. i (1797).
Simia erythræa, *Schreber, teste Shaw, Gen. Zool.* i, p. 33 (1800).
Macacus (Pithex) oinops, *Hodgs. J. A. S. B.* 1840, ix, p. 1212.
Inuus rhesus, *Blyth, Cat.* p. 8; *Jerdon, Mam.* p. 11.
Macacus rhesus, *Anderson, An. Zool. Res.* p. 55; *id. Cat.* p. 67.

Bandar, H.; *Markat*, Beng.; *Wándar*, *Puriz*, *Púnj*, or *Ponj*, Kashmir; *Gye*, Ho Kol.

Fur of moderate length (rather long in Himalayan specimens) and straight, not wavy or woolly. Hair of crown not radiating from centre. Tail two fifths to one half the length of the head and body, tapering, not tufted at the end. Caudal vertebræ usually 17 or 18. Ears naked. Buttocks naked for some distance around the callosities.

Colour. General colour hair-brown with a greyish tinge, the hinder quarters being generally rufous or yellowish, especially in adults. The hair is ashy towards the base, and more or less annulated and tipped with light brown throughout the upper parts, giving a minutely speckled appearance. Lower parts scarcely paler.

Face and callosities flesh-coloured, being bright red in adults at all times.

Dimensions. Head and body 22 inches, tail 10 without the hairs, 11 with, hand 4½, foot 6. These are the measurements (by Hodgson) of a very large individual, doubtless a male. Females measure much less, body 16 to 18 inches, tail about 6 to 7. Skull of a male 5 inches long from occiput, 3·5 from foramen, breadth across zygomatic arches 3·55 ; of a female 4·3 and 3 inches long, 3·1 broad.

Distribution. The Rhesus is the common monkey of Northern India from the Himalayas to the Godavari river. It is found in Kashmir up to an elevation of 5000 feet (10,000 according to some authorities), and there is a colony, I believe of this species, on the top of Jako hill, about 8500 feet high, at Simla. Specimens have also been sent from Nepal by Hodgson (as *M. oinops*) and by Mandelli from Sikhim, but from low elevations. *M. rhesus* is found close to the west coast near Bombay, but not much further south ; it is common throughout Guzerat and the Central Provinces, in Bengal, Orissa, and parts of the Northern Circars. There is a specimen in the Calcutta Museum from Samaguting, in Assam, and Anderson met with a form not distinguishable from this in Upper Burma and Yunnan. All the specimens obtained, however, were in captivity, but he saw a colony of wild monkeys that appeared to belong to this species on the Irawadi below Yenankhyoung. Closely allied forms (*M. lasiotis* and *M. cyclopis*) occur in China.

Habits. Although this monkey is not regarded as sacred by Hindus, it is never molested by them, and in many parts of the country it is as impudent as the Hanumán and even more mischievous. Very intelligent, and, when young, fairly docile, it is one of the commonest animals kept tame, and throughout Northern India it is the monkey carried about by itinerant showmen, and taught to perform tricks of various kinds. It is a most amusing creature, the incarnation of mischief and curiosity, but frequently rather ill-tempered. Older individuals are usually savage.

In the wild state it is found in herds, often of considerable size. It has generally but little fear of man, and may occasionally be found in native villages, though less commonly than the Hanumán. It is very frequently seen on the ground searching for food, and it eats spiders and many kinds of insects, especially Lepidoptera and Orthoptera, besides fruits and seeds. Flocks of this monkey are more frequently seen near cultivation, especially around tanks or amongst trees on the banks of streams, than in forest jungle. These animals are very quarrelsome, perpetually screaming and fighting, or teasing each other—in fact, they behave very much like unruly children.

M. rhesus swims well and takes readily to water.

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4. **Macacus assamensis.** *The Himalayan Monkey.*

Macacus assamensis, *McClelland, Horsfield, P. Z. S.* 1839, p. 148; *Anderson, An. Zool. Res.* p. 64; *id. Cat.* p. 70.
Macacus (Pithex) pelops, *Hodgson, J. A. S. B.* ix, p. 1213 (1840).
Inuus pelops, *Jerdon, Mam.* p. 11.
? Macacus problematicus, *Gray, Cat. Monkeys &c. B. M.* 1870, p. 128.
? Macacus rheso-similis, *Sclater, P. Z. S.* 1872, p. 495, pl. xxv; *ib.* 1875, p. 418.

Fur of moderate length, wavy, and, in Himalayan specimens, distinctly woolly in texture. Hair of crown often indistinctly radiating, not lengthened. Tail nearly half as long as the head and body, not tufted. Buttocks well covered with hair, except on the callosities.

The skull differs but little from that of *M. rhesus*, except in being larger, but appears higher, with a deeper lower jaw.

Colour. Above uniform dark brown, without any grey tinge; hinder parts the same, not rufescent, as in *M. rhesus*; lower parts distinctly paler. Fur destitute or nearly destitute of annulation, and, in general, of pale tips, slightly lighter in colour, but not ashy, at the base. Face dusky (perhaps variable).

Dimensions. Adults apparently are considerably larger than *M. rhesus.* Head and body (probably of an average specimen) 20 inches, tail 9½; of another, a female, 17·2 and 7·6. A male, nearly adult, skull from Upper Burma measures 5·54 inches in extreme length from occiput to premaxillaries, and 3·63 broad, according to Anderson. An adult female skull from Nepal measures 4·7 inches in extreme, and 3·2 in basal length, 3·3 broad.

Distribution. The Himalayan range as far west as Masuri, or perhaps further, from near the base of the hills to a considerable elevation; also Assam, the Mishmi hills, and Upper Burma near Bhamo, whence obtained by Anderson. The same species appears also to be found in the Sandarbans east of Calcutta *, and there is in the British Museum a specimen very probably of the same animal from the Laos country in Upper Siam. In Sikhim this species is generally seen between 3000 and 6000 feet above the sea. McClelland's original type was from Assam, possibly from the hills to the northward. The type of *M. problematicus* of Gray was from Dhalimkot in Bhutan.

Habits. This species much resembles *M. rhesus*, but is, whether wild or tame, more sluggish in all its movements. Its voice, too, is different, though the difference is small.

I was at first disposed to consider the Himalayan form, *M. pelops*, distinct from *M. assamensis*, but after going over all the evidence

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* Anderson, P. Z. S. 1872, p. 529, and An. Zool. Res. p. 64. In his last work, the 'Catalogue of Mammalia in the Indian Museum,' Calcutta, p. 68, Anderson has referred the Sandarban specimens to *M. rhesus*, on account of certain cranial characters, and especially the size of the skull. The description, however, agrees with that of *M. assamensis* in what I believe to be the characteristic peculiarities of that species.

I am inclined to agree with Anderson, who unites them, and who fortunately was able to examine and describe the type of the last-named form, now no longer to be found. That the Sikhim monkey is perfectly distinct from *M. rhesus* I am certain, and I have seen several young specimens of the former tame. They appear stouter, and differ in fur, coloration, visage, and habits, and I think the limbs are proportionally shorter.

5. **Macacus silenus.** *The lion-tailed Monkey.*

Simia silenus, *Schreb. Säugethiere*, i, p. 87, pl. xi, *partim* (*nec Linn.*).
Simia ferox, *Shaw, Mus. Leverianum*, p. 69, pl. (1792).
Inuus silenus, *Blyth, Cat.* p. 7; *Jerdon, Mam.* p. 10.
Silenus veter, *Gray, Cat. Monkeys &c. B. M.* 1870, p. 32 (*nec* Simia veter, *Linn.*).
Macacus silenus, *Anderson, An. Zool. Res.* p. 93; *id. Cat.* p. 66.

Shia bandar, H.; *Nil bandar*, Beng.; *Chingala, Nella manthi*, Mal.; *Singalika*, Can.; *Karingode*, Kurg.; *Kondamachu*, Tel.; *Kurankarangu*, Tamul.

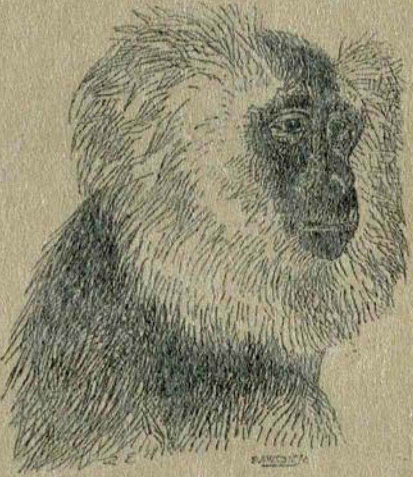

Fig. 5.—*Macacus silenus.*

Fur long. A ruff of longer light-coloured hair on chin, throat, cheeks, and temples, encircling the head, except on the forehead, and concealing the ears, which are naked. Hair radiating from centre of crown. Tail slender, about one half to three quarters the length of the head and body, and tufted at the tip; caudal vertebræ 17.

Colour. Black throughout, except the beard and ruff, which are grey. In some young specimens the abdomen is brown. Face and hands black, the callosities of a fleshy tinge.

Dimensions. Head and body of a male 21 inches, tail $13\frac{1}{2}$: of another 20 and 15: of a female, head and body 18, tail $12\frac{1}{2}$; of another specimen 18 and 10. These are from Travancore specimens measured by Mr. F. W. Bourdillon, and show much variation in the length of the tail. A female skull measures:—Length to occiput 4·4 inches, basal length 3·1, breadth 2·9.

Distribution. The forests of the Syhadri range or Western Ghats near the Malabar coast from about 14° north to Cape Comorin, and at a considerable elevation above the sea. Most common in Cochin and Travancore.

Habits. The lion-tailed Monkey, according to Jerdon, to whom we are indebted for the only authentic account of this animal in a wild state, inhabits the most dense and unfrequented forests of the hills near the Malabar coast in herds of from twelve to twenty or more. It is shy and wary. In captivity it is sulky and savage, and not easily taught. The call of the male is said (J. A. S. B. xxviii, p. 283) to resemble the voice of a man.

As I have shown elsewhere (P. Z. S. 1887, p. 620), this monkey is not *Simia silenus* of Linnæus, nor is it *S. veter* of the same author. As, however, the specific name *silenus* has been used generally for this species for more than a century, naturalists are unwilling to change it. The name Wanderoo, usually applied to *M. silenus* by European naturalists, is also a mistake, being the Ceylon name of the *Semnopitheci*, erroneously given to the present species by Buffon. The "lion-tailed Monkey" is a name of Pennant's.

6. **Macacus arctoides.** *The brown stump-tailed Monkey.*

Macacus arctoides, *Is. Geoffr. Mag. Zool.* 1833, Cl. i, pl. 11; *Murie, P. Z. S.* 1872, p. 770; *Anderson, An. Zool. Res.* p. 45, pls. i, ii; *id. Cat.* p. 74.
Papio melanotus, *Ogilby, P. Z. S.* 1839, p. 31.
Macacus brunneus, *Anderson, P. Z. S.* 1871, p. 628; *id.* 1872, p. 203, pl. xii (juv.).
Inuus speciosus, *Blyth, Mam. Birds Burma,* p. 6.

Hair on head and shoulders very long, as much as $4\frac{1}{2}$ inches in adults. Tail very short, almost rudimentary, sparsely clad with hair or naked in old animals; buttocks naked for some distance around callosities. Caudal vertebræ 11 (probably fewer in some individuals).

Colour. Dark brown; in some specimens blackish brown above, paler below. In the young the hairs are the same tint throughout, in older individuals the terminal portion of each hair is very closely and minutely annulated with several alternating rings of golden yellow and dark brown. Face and buttocks bright red.

Dimensions. Probably about 2 feet in length, the tail only one to two inches. No trustworthy measurements of adults are recorded. An adult male skull measures 5·3 inches in extreme length, 3·7 in basal length, and 3·5 in zygomatic breadth.

Distribution. Not very well ascertained. Apparently this monkey is found in some of the hill-ranges south of Assam, and there is a specimen in the Calcutta Museum said to have been brought from Tipperah. To the eastward this form is found in the Kakhyen hills of Upper Burma and also in Cochin China.

Habits. Nothing is definitely known of this monkey in the wild state. It is said to be a hill species.

Blyth refers the present form to *M. speciosus* of F. Cuvier, a name generally applied to a Japanese species, and Anderson is disposed to concur. *M. speciosus* is said by Temminck ('Fauna Japonica') to have been founded on a drawing by Diard or Duvaucel of a monkey living at Barrackpur near Calcutta. The figure resembles a pig-tailed Monkey (*M. nemestrinus*) with most of its tail cut off as much as it does either *M. arctoides* or the Japanese species. I agree with Anderson that the name *M. speciosus* should be dropped.

A stump-tailed monkey of rufous-brown coloration, said to be from the Malay Peninsula, has been named *M. rufescens* by Anderson (P. Z. S. 1872, pp. 204, 495, pl. xxiv); and two other forms, *M. maurus* and *M. ocreatus*, inhabit some of the Malay islands. A very large form, *M. tibetanus*, has been described from Moupin, in Eastern Tibet, by A. M.-Edwards. In his latest work Anderson has united this form to *M. arctoides*.

I am informed by Mr. W. Davison that he had for some time alive a monkey of a kind apparently allied to *M. arctoides*, which had been captured by a shikari near Bankasún in the extreme south of Tenasserim. Mr. Davison has also seen a second specimen, a female, his own being a male. Unfortunately the first specimen was subsequently lost. These animals were of a pale cream-colour throughout, slightly tinged with rusty on the shoulders and back; face and hands flesh-coloured. The tail was quite rudimentary, less than an inch long, and turned on one side in both specimens, so that at the first glance both appeared to be tailless. Both were very small, although shown to be adults by the teeth,—each being not above 15 inches high when it stood erect. They had a sharp piercing voice, and exhaled a peculiar fetid odour. The one kept by Mr. Davison was excessively insectivorous, and preferred insects to fruit or bread. These monkeys apparently belonged to an undescribed species.

It is quite possible, too, that the large tailless ape seen by Mr. Davison and Captain Bingham in the Tenasserim mountains, and described in the notes on *Hylobates lar* (*ante*, p. 9), may be an ally of *M. arctoides*, though apparently much larger than that species.

7. **Macacus leoninus.** *The Burmese pig-tailed Monkey.*

Inuus leoninus, *Blyth, Cat.* p. 7 (1863); *id. Mam. Birds Burma*, p. 4.
Macacus andamanensis, *Bartlett, P. Z. S.* 1869, p. 467.
Macacus leoninus, *Sclater, P. Z. S.* 1870, p. 663, pl. xxxv; *Anderson, An. Zool. Res.* p. 52; *id. Cat.* p. 71.

Myouk-mai, Burm.; *Myouk-la-haing*, Arakan.

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A somewhat short-limbed, stout form. The hairs on the shoulders and fore part of back very long, 4 to 5 inches in males, but rather short on the lower back and rump. Head broad, rather flat; hair radiating in the centre of the crown and surrounded in front and on both sides by a horseshoe-shaped crest, the anterior or supraorbital portion of which consists of very stiff hairs. Tail about one third the length of the head and body, slender, well clad with hair. Caudal vertebræ 17 to 18.

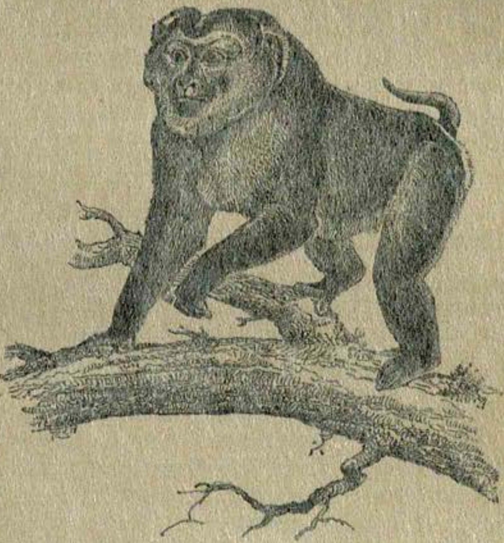

Fig. 6.—*Macacus leoninus*. (P. Z. S. 1870, pl. xxxv.)

The skull is distinguished from that of *M. nemestrinus* by having the muzzle much shorter.

Colour. Males are dark brown above, the horseshoe-shaped crest, the lower back, and the upper surface of the tail black; sides of head and buttocks grey; lower parts, including lower surface of tail, light greyish brown. The tail is somewhat tufted, and has sometimes a bright ferruginous tuft at the end. Females are greyer and rather paler, and have no black on the head or back, though the tail is blackish above. The fur is finely annulated, except on the head, loins, tail, and buttocks, with yellow and blackish brown above, and with dusky and whitish below. On the long hair of the shoulders there are as many as ten to twelve rings, five or six of each colour, on each hair. Base of hair greyish brown. Face dusky flesh-colour.

Dimensions. Length of male: head and body 23 inches; tail without hair at end 8, with hair 10. Females considerably less. Skull of adult male 5·3 inches long from occiput, 4 from foramen, and 4 broad across the zygomatic arches; of a female 4·45 and 3·1 inches long and 2·95 broad.

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CSL

Distribution. Originally described from specimens collected by Sir A. P. Phayre in Arakan. Anderson has since referred to this species specimens from Upper Burma, and a young animal from Perak. Malacca. The latter identification is very questionable, as the Malay peninsula is inhabited by the true pig-tailed Monkey, *M. nemestrinus.* A few individuals have been introduced into the Andaman Islands, but the species is not indigenous.

Habits. Scarcely anything is known, except that the young and females are docile in captivity, old males fierce. In this, as probably in most other respects, this species is very similar to the next.

8. **Macacus nemestrinus.** *The pig-tailed Monkey.*

Simia nemestrina, *Linn. Syst. Nat.* i, p. 35 (1766).
Inuus nemestrinus, *Blyth, Cat.* p. 7.
Macacus nemestrinus, *Anderson, An. Zool. Res.* p. 77; *id. Cat.* p. 72.

Myouk-padi, Burmese; *Ta-o-ti,* Burmese of Tavoy; *Bruh,* Malay.

Body stout; limbs long and powerful; muzzle in adults much produced. Fur slightly lengthened over shoulders, and short generally. Hair radiating in centre of crown, but not surrounded by the distinct horseshoe-crest of *M. leoninus* (there is, however, an approximation to it in some specimens). Tail very slender, rather more than one third the length of the head and body. Caudal vertebræ 18.

The muzzle, in old male skulls especially, is greatly produced, and much resembles that of the Baboons (*Cynocephalus*) in form. The orbits are nearly as high as broad.

Colour. Crown of the head dark brown or black, except at the sides; a broad black stripe extends throughout the middle of the back in many specimens, becoming broader on the rump; but in young animals and in some adults the back is brown throughout. Fur of upper surface generally yellowish brown, but varying from pale orange-brown to blackish brown in different specimens; lower parts greyer brown or albescent; hands and feet sometimes darker than the limbs. Tail black above, light yellowish brown below. The fur on the upper parts and the outside of the limbs is closely annulated with yellow and brown; basal portion of hair grey.

Dimensions. Tickell gives as the measurements of an old male from Yé:—Head and body 18$\frac{1}{4}$ inches, tail 7$\frac{3}{4}$, hand 3$\frac{3}{4}$, foot 6, height at shoulder 16; the size, however, varies much, and many individuals attain a much greater development, rivalling, as Anderson remarks, a good-sized mastiff both in height and strength. Of two skulls of adult males in the British Museum one measures 6·5 inches long from the occiput and 5 from the foramen, by 4·2 broad across the zygomatic arches; whilst another male adult skull is only 5·78 and 4·4 long and 3·8 broad; and a third from Mergui 5, 3·6, and 3·5. Females must be very nearly as large as males; the skull of a very old specimen from Tenasserim is 6·2 and 4·2

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inches long and 4·25 broad. It is just possible that two distinguishable forms, a larger and a smaller, are indicated by these measurements.

Distribution. The pig-tailed Monkey is found throughout a great part of Tenasserim, although apparently not common, except in the extreme south of the province—a circumstance that probably explains why the occurrence of *M. nemestrinus* in Southern Burma has been generally overlooked. There is, however, a skeleton in the British Museum (the old female of which the skull-measurements are given above) sent by Major Bingham from Meplay valley, Thoungyeen river, and a skull presented by Dr. Oldham from Mergui. Tickell, too, in his MS. notes, records and describes specimens from Yé; and Mr. W. Davison tells me that the species is common about Malewún and Bankasún. The pig-tailed Monkey is not found north of Tenasserim, but extends south into the Malay Peninsula, Sumatra, and Borneo.

Habits. The pig-tailed Monkey in Tenasserim, according to Tickell, frequents thick jungle about the base of the hills. The voice and manners are similar to those of *M. rhesus.* When the animal is excited the tail is held in the form of an S. In Sumatra *M. nemestrinus* is said by Sir S. Raffles to be peculiarly docile, and to be trained to climb the cocoa-nut trees and gather nuts for its master. This can only apply to females and young animals; old males are very savage, and they are formidable animals from their size and strength.

The period of gestation in this species has been ascertained to be 7 months and 20 days.

9. **Macacus cynomolgus.** *Macaque, or crab-eating Monkey.*

Simia cynomolgus, *Schreb. Säugth.* i, p. 91, pl. xiii (fig. *Buffon*), *nec Linn.*

Macacus irus, *F. Cuv. Mém. Mus.* iv, p. 120 (1818).

Macacus carbonarius, *F. Cuv. Hist. Nat. Mam.* pl. xxxii (1825); *Blyth, Cat.* p. 9.

Macacus aureus, *Is. Geoffr. Voy. Bél., Zool.* p. 58.

Macacus cynomolgus, *Blyth, Cat.* p. 9; *id. Mam. Birds Burma*, p. 7; *Anderson, An. Zool. Res.* p. 73; *id. Cat.* p. 61.

Myouk-ta-nga, Burmese; *Ta-o-tan*, Tavoy and Arakan; *Kamui-awut*, Talain; *Da-ouk*, *Sha-ok-li*, Karen; *Krá*, Malay.

Fur of moderate length and nearly straight. Hair of the crown not lengthened, and usually directed backwards, but occasionally radiating somewhat irregularly from one or more centres, or forming a rudimentary crest. Tail nearly as long as the head and body. Caudal vertebræ 22.

Skull long and low, with the muzzle produced, and the orbits much broader than high.

Colour. The general tint of the upper surface varies from dusky or greyish brown to rufous or golden brown in different individuals; lower parts light greyish brown to nearly white. The hair of the upper parts varies from light brown to almost black at the base, the terminal portion being annulated with yellow and brown or black; on the shoulders there are usually three rings of each colour, fewer behind. In young specimens there is no annulation. Face, ears, and callosities varying from flesh-colour to dusky. Eyelids white or bluish white in many cases.

Varieties. There are two prominent varieties of this well-known monkey—a dark-coloured form with dusky face (*M. carbonarius*), and a golden-rufous race (*M. aureus*). Both of these, as well as the normal yellowish-brown type, are found in Burma. The colour of the face varies greatly, some dark-furred individuals having a pale face, and *vice versâ*.

Dimensions. An old male measures:—head and body 22 inches, tail 19, hand 3·9, foot 5·5. In another the head and body are about 21 inches, tail 20. Females are smaller. A large adult male skull measures 5·3 inches in extreme length, 4·1 from anterior margin of foramen magnum, and 3·6 in breadth across the zygomatic arches; a female skull 4·35, 3, and 2·9 in the three dimensions.

Distribution. The crab-eating Monkey is found throughout a great part of Burma, including Arakan, especially along tidal creeks near the coast, and in the deltas of rivers. It is not known to occur on hills, nor has it been recorded with certainty from Upper Burma. It is found in the Nicobar Islands (? introduced), but not in the Andamans. Beyond our area it has a wide range throughout Siam and the Malayan peninsula and islands.

Habits. Tickell, in his MS. notes, gives an excellent description of this animal, from which most of the following details are derived. He says that these monkeys are usually met with in small parties of five to fifteen, consisting of one old male, four or five females, and their young. They are especially common on the banks of tidal creeks, where they live amongst the mangroves, and feed upon seeds, Crustacea, and insects. The claws and body of a crab were found in the cheek-pouch of a female shot in Arakan by Captain (afterwards Sir A.) Phayre. The tidal creeks are, in Tenasserim and Arakan, and in the delta of the Irawadi, the only highroads of the country; the monkeys, consequently, become familiarized with the sight of men, and will allow of a near approach and even pick up rice or fruit thrown to them. This I can confirm from my own observation; I have even known them, in Pegu, follow a boat for some distance.

They swim and dive well. Tickell mentions an instance of a wounded male, that had been shot and placed in a boat, jumping overboard and diving repeatedly, once to a distance of 50 yards, in order to avoid recapture.

There is no particular season for breeding. The young clings tenaciously to the mother for the first month, after which it ventures out little by little, and, to quote Tickell, "it is exceedingly amusing to watch the rough tenderness with which the latter [the mother] checks at first the over-venturesome sallies of the little animal, which is often pulled back by the tail, chastised with a cuff on the head, and then gravely huddled up to the breast, where the shrieks and chattering of the delinquent, which is just as fractious as a child under such circumstances, are soon appeased."

Like the rest of the genus, this monkey is easily tamed if taken young; it is intelligent and full of antics. The females continue gentle, but the males become morose and savage as they grow old.

This species is the Macaque of Buffon, but is not the *Simia cynomolgos* of Linnæus, which is an African baboon. F. Cuvier called attention to these facts in 1818, but his remarks appear to have been generally overlooked. As in the case of *M. silenus*, the name has been used too long to be altered now with a probability of a less familiar term being generally accepted.

10. **Macacus sinicus.** *The Bonnet Monkey.*

Simia sinica, *Linn. Mantissa*, p. 521 (1771).
Cercocebus radiatus, *Geoffr. Ann. du Mus.* xix, p. 98 (1812).
Macacus radiatus, *Blyth, Cat.* p. 8; *Jerdon, Mam.* p. 12.
Macacus sinicus, *Anderson, An. Zool. Res.* p. 90; *id. Cat.* p. 59.

Bandar, H.; *Makadu, Wánar, Kerda*, Mahr.; *Manga, Kodaga*, Can.; *Koti*, Tel.; *Koranga, Vella manthi*, Mal.; *Kurangu*, Tamul; *Mucha*, Kúrg; *Kodan*, Toda.

Fur of moderate length, generally straight and smooth. Hair of the crown lengthened and radiating from the vertex, but not usually extending over the forehead, where the shorter hair is parted, as a rule, down the middle. Tail nearly or quite as long as the head and body. Caudal vertebræ 22.

The skull is long, flattened over the brows, with the orbits much broader than high and nearly vertical. Compared with the skull of *M. rhesus*, that of *M. sinicus* is vertically much lower; thus the skull of which the measurements are given below is 3·05 inches in height, the mandible included, whilst a skull of *M. rhesus* one tenth of an inch shorter is, with its mandible, 3·5 inches high.

Colour. Hair-brown to greyish brown above, pale brown or whitish below. Fur annulated towards the ends in some specimens. Face and ears flesh-coloured.

Dimensions. Head and body of an adult male 19½ inches, tail 22; weight 16 lbs. The tail, however, is generally rather longer in proportion. An adult male skull is 4·8 inches long from occiput, 3·5 from foramen, and 3·5 broad across the zygomatic arches.

Distribution. Southern India, extending on the West Coast to the neighbourhood of Bombay, but on the East not further than the Godavari; it is doubtful indeed if this species is found so far north as that river.

This monkey is replaced in Ceylon by the next, which appears only to differ in colour. In general *M. sinicus* has shorter and smoother fur, and the radiating hair on the crown is shorter, not extending to the forehead, but a specimen from Travancore in the British Museum has rough hair like *M. pileatus* devoid of annulation, and an unusually long topknot.

Habits. Very similar to those of other members of the genus. This is the common monkey, tame or wild, of Southern India, found both in wild jungles and in populous towns, where it pillages the shops of the dealers in fruit and grain. Jerdon says "it is the most inquisitive and mischievous of its tribe, and its powers of mimicry are surpassed by none." I do not think that it can excel *M. rhesus* in inquisitiveness and mischief, but I believe that it is, on the whole, more docile.

11. **Macacus pileatus.** *Toque Monkey.*

Simia pileata, *Shaw, Gen. Zool.* i, pt. 1, p. 53 (1800).
Macacus sinicus, *Kelaart, Prod.* p. 8, *nec Linn.*
Macacus pileatus, *Blyth, Cat.* p. 9; *Anderson, An. Zool. Res.* p. 91; *id. Cat.* p. 61.

Raláwa, Cingalese.

Hair rather long, wavy and rough, that of the crown forming a topknot radiating from the vertex, and considerably lengthened, extending in front nearly to the eyebrows. Tail nearly as long as head and body. Caudal vertebræ 24. The skull is similar to that of *M. sinicus*.

Colour. Rufous or yellowish brown above, white or whitish below. The upper surface of the tail, hands, and feet sometimes more dusky. Fur hair-brown at base, tipped and sometimes annulated with rufous or yellow. Face and callosities flesh-coloured. Ears, palms, and soles dusky.

Dimensions. Head and body of an adult male 21 inches, tail 18 (*Kelaart*). Schlegel gives 20 and 23 inches, probably from skins. A male adult skull is 4·9 inches in extreme length, 3·5 in zygomatic breadth.

According to Kelaart the present form is of less robust make and smaller size than the Southern Indian form, but it is very doubtful if there is any constant difference. For my own part, I doubt if the two are entitled to specific distinction.

Distribution. Ceylon, throughout the island.

Habits. Precisely the same as those of *M. sinicus*. Kelaart says that the latter is more intelligent and less mischievous; but, as already remarked, the two are probably mere varieties of the same species. *M. pileatus* is the monkey commonly kept tame in Ceylon, and carried about by jugglers and itinerant mountebanks for the amusement of children, exactly as *M. rhesus* is in Northern and *M. sinicus* in Southern India. It may be mentioned here that those who have only seen monkeys in Europe, and especially in cages, have in general a very imperfect idea of the intelligence, love of fun, and power of mimicry that these animals possess.

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Subfamily SEMNOPITHECINÆ.

The members of this subfamily are easily distinguished by their slender form, and by the absence of cheek-pouches. They are more purely herbivorous than the Macaque monkeys, and a considerable portion of their food consists of leaves and young shoots. Their digestive organs are much modified, and the stomach bears some resemblance to that of ruminant ungulates, being large in size and divided into three portions. In consequence probably of the more restricted nature of their food, these monkeys are far more delicate than the species of *Macacus*, and are less easily kept alive in confinement. They are consequently not nearly so well represented in European museums, and they have been less studied by European naturalists. Very little is known of their breeding-habits or of their life-history in general.

The only Indian genus is *Semnopithecus*, which is found almost throughout the Oriental region. The corresponding African genus *Colobus* is distinguished by having the thumb of the hand rudimentary.

For descriptions of the anatomy, see Otto, Acad. Cæs. Leop. Nova Acta, xii, 1825, p. 505 (a partial translation of this appeared in the 'Zoological Journal,' vol. iii, p. 249); Owen, Trans. Zool. Soc. i, p. 65; and Murie, P. Z. S. 1865, p. 740.

Genus **SEMNOPITHECUS** *, F. Cuvier, 1821.

Syn. *Presbytis*, Eschscholtz.

Body and limbs slender. Tail long, exceeding in length the head and body together in all Indian, Ceylonese, and Burmese species. Thumb short, but well developed. A row of long stiff black hairs across the eyebrows. Vertebræ: C. 7, D. 12, L. 7, S. 3, C. 25–30.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$.

The skull is rounder than in the Macaques, the breadth of the brain-case being relatively greater and the development of the muzzle less. The facial angle is consequently higher, although the intelligence is certainly not superior, and is apparently lower.

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* Both the genera *Semnopithecus* and *Presbytis* were proposed in the same year, 1821, the former, in the French form *Semnopithèque*, for *S. entellus* and *S. melalophos* (Hist. Nat. des Mammifères), the latter for *S. mitratus* (Kotzebue's 'Entdeckungs Reise,' iii, p. 196). The latter species is somewhat aberrant. The name *Semnopithecus* has been more widely used than *Presbytis*, and is accordingly adopted here.

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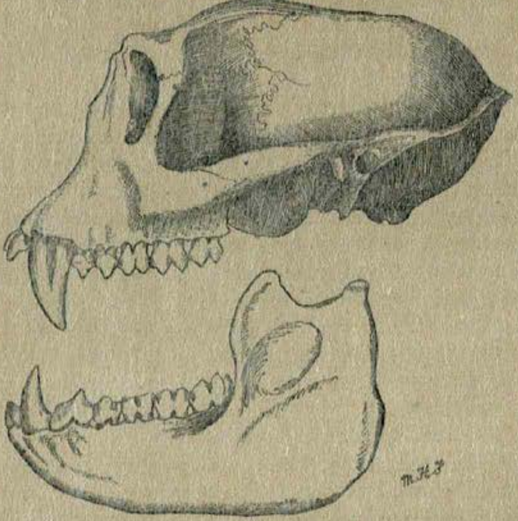

Fig. 7.—Skull of *Semnopithecus entellus*.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Hair of crown radiating from a point on the forehead.	
a. Head scarcely paler or not paler than back.	
a'. Hands and feet black. No crest......	*S. entellus*, p. 27.
b'. Hands and feet same colour as limbs. A crest........................	*S. priamus*, p. 31.
b. Head distinctly paler than back.	
a'. Hands and feet black, lower parts yellowish	*S. hypoleucus*, p. 33.
b'. Hands and feet scarcely darker than limbs, lower parts greyish	*S. schistaceus*, p. 30.
B. Hair of crown radiating from two frontal points, one on each side.	
a. Nearly black above, inside of thighs white	*S. femoralis*, p. 42.
C. Hair of crown directed backwards throughout, not radiating.	
a. No crest; hair of crown not longer than on temples and nape.	
a'. Body black or dusky brown above and below.	
a''. Head black throughout, like body ..	*S. barbei*, p. 39.
b''. Head pale brown, cheeks same colour as crown	*S. johni*, p. 33.
c''. Cheeks paler than crown, sacral region grey	*S. cephalopterus*, p. 34.
d''. Cheeks paler than crown, sacral region black....................	*S. ursinus*, p. 36.
b'. Body yellowish white throughout	*S. senex*, p. 35.

b. No crest. Hairs of crown longer than those of temples and occiput, and forming a cap. Body dark grey above, yellow below .. *S. pileatus*, p. 37.
c. A crest of longer hairs.
  a'. A pointed crest on occiput. Adults ashy to blackish brown, young yellowish brown .... *S. obscurus*, p. 41.
  b'. Crest compressed and longitudinal on crown of head; body dark grey above, whitish below .... *S. phayrei*, p. 39.
d. A crest ? Black above, ferruginous below, neck white; young rufescent white throughout .... *S. chrysogaster*, p. 38.

The remains of a single species of *Semnopithecus* have been found in the Siwalik beds, and those of another in the Pleistocene Cave-deposits of Kurnool.

12. **Semnopithecus entellus.** *The Langúr or Hanúmán Monkey.*

Simia entellus, *Dufresne, Bull. Soc. Phil.* 1797, p. 49.
Semnopithecus entellus, *Blyth, J. A. S. B.* xii, p. 169, xiii, p. 470; *Hutton, P. Z. S.* 1867, p. 944; *Anderson, An. Zool. Res.* p. 15; *id. Cat.* p. 35.
? S. anchises, *Elliot, Blyth, J. A. S. B.* xiii, p. 470, xvi, p. 733.
Presbytis entellus, *Blyth, J. A. S. B.* xvi, pp. 372, 1271, pl. liv, fig. 1; *id. Cat.* p. 11; *Jerdon, Mam.* p. 4.

Langúr and *Hanúmán*, Hindi; *Wánar*, Maráthi; *Musya* *, Canarese; *Kode*, Kúrg; *Sárá*, Korku (Sátpura Hills) and Ho (Kol).

No crest. Hair on the crown of the head radiating in all directions from a point about one-third the distance back from the eyebrows to the occiput. Ears large, not covered by the hair of the cheeks. Hair of the body of the same colour throughout, and generally somewhat wavy.

Colour. Head, body, limbs, and tail pale earthy or greyish brown, or pale isabelline throughout; hands and feet always black above. The back and the outside of the limbs are sometimes darker, and the lower parts paler; the head too is said to be occasionally lighter in colour, but the difference is not great. Face, ears, and soles of hands and feet black.

Dimensions. Average size of an adult male :—head and body about 2 feet long; tail, without hair at end, 38 inches. Females are rather less. Large males measure considerably more; head and body 30 inches, or even more according to Jerdon. Weight of a male 22 lbs., of a female 18 lbs. An adult male skull measures: extreme length from alveolar border of premaxillaries to back of head 5·05 inches, to foramen (basal length) 3·6, width across the zygomatic arches 4.

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* This and the next name may belong to *S. priamus*.

Distribution. The northern portion of the Indian Peninsula, including South-western Bengal, Orissa, the Central Provinces, Bombay, Guzerat, Southern Rájputána and part of the N.W. Provinces, extending to Kattywar and probably to Cutch (J. A. S. B. xli, pt. 2, p. 220), but not to Sind or the Punjab. Hutton states that this species is not indigenous east of the Hugli or north of the Ganges, and of a line drawn westward from Allahabad to near Búndi on the Chambal, and that colonies found near certain Hindu shrines, as Muttra in the North-west Provinces and Kishnagurh in Bengal, have been introduced. The latter is probable, but it is certain that Langurs occur in the Oudh Terai, and generally along the base of the Himalaya (Jerdon mentions their occurrence near Pankabari, in Sikhim), and they are more likely to be this species than *S. schistaceus*. It is remarkable that the range of so well-known an animal should be so imperfectly ascertained. The southern limit of *S. entellus* also needs verification. This is certainly the species inhabiting the Bombay Deccan; but Blyth mentions (J. A. S. B. xiii, p. 471) an immature black-handed specimen from Coimbatore, well within the range of the pale-handed *P. priamus*, and Lydekker has referred to *S. entellus* the remains from the Kurnool caves. The range of this Langur on the Eastern coast extends, I believe, south of the Godavery.

Habits. Few, if any, wild animals afford better opportunities for observation than the Hanúmán Monkey of Northern and Central India. Generally protected, and looked upon as sacred by many of the Hindu inhabitants, it has no fear of man and may be found in groves near villages, or even in the village trees, as commonly as in the depths of the forest. In many parts of India it is a common occurrence to see these monkeys on the roofs of houses. They frequently pilfer food from the grain-dealers' shops, whilst the damage they inflict on gardens and fields renders them so great a nuisance that the inhabitants of the country, although they will not as a rule kill the monkeys themselves, sometimes beg Europeans to shoot the intruders.

S. entellus feeds on fruit and grain, seed, seed-pods (for instance gram), leaves and young shoots, the last two forming a large portion of its food. Certain vegetable poisons are said to be taken by this monkey with impunity, doses of 5 and even 10 grains of strychnine having been given to one without effect, although the same drug killed *Macacus rhesus* quickly.

The Hanúmán is usually found in smaller or larger communities, composed of individuals of both sexes and of all ages, the youngest clinging to their mothers and being carried by them, especially when alarmed. An old male is occasionally found solitary, as with so many other mammals. The story that males and females live in separate troups, though apparently believed by Blyth and quoted by Jerdon, I agree with Hutton in regarding as fictitious, though, as the latter observer justly remarks, females with very young offspring may keep together and temporarily apart from the remainder of the troup to which they belong.

I also doubt the details of the story, quoted, like the last, from the 'Bengal Sporting Magazine' for 1836, of combats between the males for the possession of the females. But the occurrence of fights amongst these animals rests on good evidence. Mr. T. H. Hughes (Proc. A. S. B. 1884, p. 147) described a combat, witnessed by himself in April, between two communities of Hanúmáns, apparently for the possession of a mango-grove. Only the champion males of each flock engaged at first, two from the larger flock, one from the smaller; but after one of the former had been killed, his throat being torn open by his adversary's teeth, two females came to the assistance of the survivor, and the single champion of the opposite side was mortally wounded, whereupon several of the weaker flock appeared to be taken prisoners by the others. The whole account is very interesting.

Away from villages, the high trees on the banks of streams or of tanks, and, in parts of Central India, rocky hills are the favourite haunts of these monkeys. They are never found at a great distance from water. Whether on trees, on rocks, or on the ground they are exceedingly active. "They leap with surprising agility and precision from branch to branch, and when pressed take most astonishing jumps. I have seen them cross from tree to tree, a space of 20 to 30 feet wide, with perhaps 40 or 50 feet in descent. They can run on all fours with considerable rapidity, taking long strides or rather bounds" (*Jerdon*). They leap from rock to rock as readily as from tree to tree. But great as their apparent speed is, McMaster found that on horseback he easily ran down a large male in a very short distance; indeed, it is their power of bounding and the remarkable appearance they present whilst leaping, with their long tails turned over their backs, that convey the idea of speed, rather than the actual rapidity of their motions.

Their voice is loud and is often heard, especially in the morning and evening. The two commonest sounds emitted by them are a loud, joyous, rather musical call, a kind of whoop, generally uttered when they are bounding from tree to tree, and a harsh guttural note, denoting alarm or anger. The latter is the cry familiar to the tiger-hunter, amongst whose best friends is the Hanúmán. Safely esconced in a lofty tree, or jumping from one tree to another as the tiger moves, the monkey by gesture and cry points out the position of his deadly enemy in the bushes or grass beneath, and swears at him heartily. It is marvellous to observe how these monkeys, even in the wildest forests, where human beings are rarely seen, appear to recognize the men as their friends, at least as allies against the tiger. It is a common but erroneous notion of sportsmen that this guttural cry is a sure indication of a tiger or leopard having been seen, whereas the monkeys quite as often utter it merely as an expression of surprise; I have heard it caused by the sight of deer running away, and I believe that it is frequently due to the monkeys catching sight of men.

In confinement the Hanúmán is, as Jerdon says, quite sedate

GSL

and indolent. Older animals are not unfrequently morose and savage. None of this group are so docile or so amusing as the *Macaci*, and even in the wild state the Hanúmán appears quieter, less possessed by an insatiable curiosity, less sportive, and also less quarrelsome. His behaviour is more in accordance with the extreme gravity of his appearance.

The female Hanúmán is said not unfrequently to have twins, although one young at a time is the rule, as throughout the order. The period of gestation does not appear to have been ascertained, nor the age at which these monkeys become adult.

13. **Semnopithecus schistaceus.** *The Himalayan Langur.*

Semnopithecus schistaceus, *Hodgson, J. A. S. B.* ix, p. 1212 (1841); *Anderson, An. Zool. Res.* p. 16; *id. Cat.* p. 37.
Presbytis schistaceus, *Blyth, Cat.* p. 11; *Jerdon, Mam.* p. 6.

Lángúr, Hindi.

No crest. Fur long. The hair of the crown radiates from a point some distance behind the eyebrows, as in *S. entellus*. The ears are smaller than in that species, and concealed by the long hair of the cheeks. Tail slightly but distinctly tufted at the end.

Colour. Back, tail, and outside of limbs earthy or greyish brown, frequently with a slight purplish tinge. Shoulders and a band down the fore limbs often darker. Crown and sides of head and the lower parts whitish. Feet and hands externally the same colour as the limbs, or very little darker. Face and ears black; a little black hair on parts of the face.

Dimensions. A moderate-sized individual measures 30 inches from muzzle to rump, tail 36. An adult male skull is 5·7 inches in extreme, 4·15 in basal length, 4·35 broad. This species is the largest of the Indian and Burmese forms, and probably of the whole genus.

Distribution. Throughout the greater portion of the Himalayas from Kashmir to Bhutan, the most western authenticated locality being the Wurdwan valley above Kishtwar (J. A. S. B. xlvi, pt. 2, p. 284). In Sikhim *S. schistaceus* is confined to the interior at elevations of from 7000 to 12,000 feet. It is found at similar elevations in the Western Himalayas, but it is also said to occur at the base of the Himalayas. As stated under the last species, it remains to be seen whether the Langurs of the Terai and lower Himalayan slopes are not *S. entellus*. I can find no record, by a competent naturalist, of *S. schistaceus* below 5000 or 6000 feet.

This monkey is included in a list of mammals found in the Naga hills (J. A. S. B. xliv, pt. 1, p. 332), but probably some other species has been mistaken for it. The statement that large monkeys are found in Kafiristan (J. A. S. B. xxviii, p. 332) requires confirmation.

Habits. Except in inhabiting a much cooler climate, this Langur differs but little from the Hanúmán monkey in habits. Hutton

GSL

has observed *S. schistaceus* near Simla, sporting amongst fir trees that were loaded with snow-wreaths.

According to a MS. note of Hodgson's these monkeys pair in February and have young in April or May, the period of gestation being apparently only two months. Further information is desirable.

S. schistaceus is distinguished from *S. entellus* (1) by being somewhat larger, though there is probably no great difference between large individuals of both species; (2) by the head being much paler in colour than the back, and by the feet being but little, if at all, darker than the limbs; (3) by the smaller ears, and by their being concealed by the long hair of the cheeks; (4) by the form of the skull. Dr. Anderson has shown that the skull of *S. schistaceus* is longer in proportion to the breadth, and the face is relatively longer than in *S. entellus*. If a straight edge be applied to the face, it will be found that in *S. entellus* the nasal bones do not project beyond a line drawn from the middle of the supraorbital ridge to the anterior border of the premaxillaries, whilst in *S. schistaceus* the nasals do project beyond that line. These characters appear quite constant in adults. Anderson in his last work, the 'Catalogue of Mammalia in the Indian Museum,' classes *S. schistaceus* as merely a variety of *S. entellus*, but I cannot agree.

14. **Semnopithecus priamus.** *The Madras Langur.*

Semnopithecus priam, *Elliot, Blyth, J. A. S. B.* xiii, p. 470 (1844).
Presbytis priamus, *Blyth, J. A. S. B.* xvi, p. 732, pl. liv (p. 1271); xx, p. 153; *id. Cat.* p. 12; *Kelaart, Prod.* p. 3; *Jerdon, Mam.* p. 7.
Semnopithecus albipes, *Is. Geoff. Cat. Méth. Mam.* (1851) p. 14; *Gray, Cat. Monkeys &c. B. M.* p. 15; *Anderson, An. Zool. Res.* p. 18.
Semnopithecus priamus, *Anderson, An. Zool. Res.* p. 19; *id. Cat.* p. 38.

Konda-músal, Muskaunthi, Tam.; *Gandangi,* Tel.; *Musia,* Can.; *Kunde Wandaru,* Cing.

The radiation of the hairs on the front part of the crown is less conspicuous than in *S. entellus* and *S. schistaceus*; the hairs on the hinder part of the crown are elongated along the middle line so as to form a distinct longitudinal compressed crest *. Black supraorbital fringe very long. Ears large, not covered by the hair of the cheeks. Hair of the body long, with scattered longer piles of the same colour.

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* The existence of this crest was mentioned by Blyth, Jerdon, and Kelaart, and figured by Sir Emerson Tennant, but doubted by Anderson. It is, however, distinctly shown in three dried skins from Ceylon in the British Museum, and as these skins have never been mounted the character is clearly natural. I have also seen it in skins from Southern India, and am assured by Mr. W. Davison and others that it is constantly present.

GSL

Colour. Back, outside of limbs, and tail greyish or earthy brown, sometimes with a slight pinkish tinge; head paler brown above; feet the same colour as the limbs, or a little darker, not black.

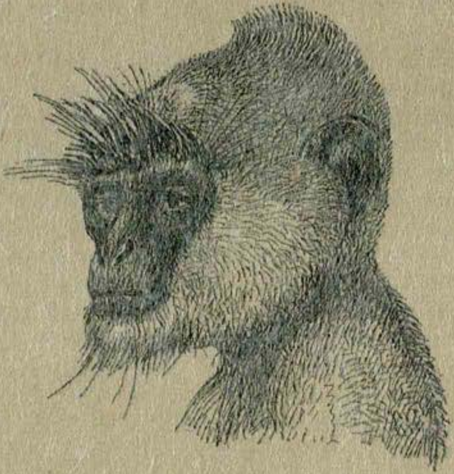

Fig. 8.—Head of *Semnopithecus priamus*.

Lower parts pale brown. Face, palms of hands, and soles of feet black.

Dimensions. Head and body 21 inches, tail 28 (a Ceylon specimen); a large Wynaad example, however, measured 23 and 37 inches. Madras specimens are probably larger than Ceylonese. An adult male Ceylon skull is 4·23 inches in extreme, 3 in basal length, and 3·35 in zygomatic breadth. Another has for corresponding dimensions 4·6, 3·28, and 3·63 inches.

Distribution. Coromandel coast and the Carnatic as far north as Nellore, also Mysore, the Wynaad, and Northern Ceylon, extending south as far as Trincomali and the skirts of the Kandyan hills. The limits of range of this species and of *S. entellus* are not exactly known. *S. priamus*, I learn from Mr. W. Davison, ascends the eastern slopes of the Nilgiri hills to an elevation of 6000 feet.

Habits. Precisely similar to those of its near ally *S. entellus*.

This species may be distinguished from *S. entellus* by having a crest, and by the feet and hands not being black above. The form of the skull is quite different, as Anderson has shown; the facial portion being much shorter and more concave. The distance from the alveolar border of the premaxillaries to the supraorbital ridge in an adult skull of *S. priamus* is 1·7, in *S. entellus* 2·25, and in *S. schistaceus* 2·7 inches. Several other differences in the cranium and mandible are noticed by Anderson.

GSL

15. Semnopithecus hypoleucus. *The Malabar Langúr.*

Semnopithecus hypoleucos, *Blyth, J. A. S. B.* x, p. 839 (1841), xiii, p. 470; *Anderson, An. Zool. Res.* p. 20; *id. Cat.* p. 40.
Semnopithecus dussumieri, *Is. Geoffr. Comptes Rendus*, xv, p. 719 (1842); *id. Descr. An. Nouv., Fam. des Singes*, p. 54, pl. xxx.
Presbytis hypoleucos, *Blyth, J. A. S. B.* xvi, p. 733.
Presbytis johnii, *Blyth, Cat.* p. 12; *Jerdon, Mam.* p. 7, *nec Fischer.*

Vella Manthi, Malayalim.

No crest. The hair on the crown of the head radiates as in *S. entellus.*

Colour. Above dusky brown, varying somewhat in tint, sometimes not much darker than *S. entellus*, but always darker in the middle of the back than on the sides. Head fulvous to dirty yellow, the crown being rather darker. Supraorbital hairs black as usual, and some black hairs before the ears. Limbs dark brown, hands and feet black; tail dark brown, the terminal portion paler. Lower parts yellow or yellowish white. Face black. Young animals are said by Jerdon to be sooty brown throughout.

Dimensions. Smaller than those of *S. entellus.* Head and body of a full-grown male 21 inches, tail 32. An adult male skull measures 4·26 inches in extreme length by 3·30 in breadth across the zygomatic arches (*Anderson*).

Distribution. The Malabar coast, especially in evergreen forests, from about 14° or 15° North lat. to Cape Comorin, ascending the hills to an elevation of about 1200 or 1300 feet. It is not confined to the forests, but frequents gardens and the belt of cultivated wooded land that extends all along the sea-coast of Malabar.

Habits. Similar to those of *S. entellus*, except that, although it is found in trees near houses, it is not familiar and rather shuns observation. It has the usual loud call of the genus, and the same kind of alarm-note when it sees tigers or other beasts of prey. It is frequently taken young and tamed.

16. Semnopithecus johni. *The Nilgiri Langúr.*

Simia johnii, *Fischer, Syn. Mam.* p. 25 (1829).
Semnopithecus cucullatus, *Is. Geoffr. Zool. Bél. Voy.* p. 38, pl. i (1834).
Semnopithecus jubatus, *Wagner, Schreb. Säugeth. Supp.* i, p. 305.
Presbytis johnii, *Blyth, J. A. S. B.* xvi, p. 734.
Presbytis cucullatus, *Blyth, J. A. S. B.* xxviii, p. 283; *id. Cat.* p. 14.
Presbytis jubatus, *Jerdon, Mam.* p. 8.
Semnopithecus johnii, *Anderson, An. Zool. Res.* p. 21; *id. Cat.* p. 45.

Turuni, Kodan, Pershk, Toda; *Korangu*, Baduga and Kurumba; *Karing Korangu*, Mal.

Hair of the crown and sides of the head very long; no radiating centre to the crown. Fur of the body long, fine, and glossy.

Colour. Glossy black to blackish brown except the head, which is some tint of brownish yellow, and the rump and base of the tail, which are generally ashy grey in adults and occasionally in the young. In the female there is always a yellowish-white patch inside each thigh (*Davison*). The very young animal is black throughout.

Dimensions. Head and body 21 to 23 inches, tail 32 to 35; weight 23 lbs. In a very large male the head and body measured 29 inches, tail 37. Females are rather smaller than males. The above measurements are from Travancore and Animalé specimens by Mr. F. Bourdillon and Mr. T. Hornaday. The skull of a female barely adult measures 2·45 inches in basal, 3·7 in extreme length, and 2·65 in zygomatic breadth, but this is doubtless a small specimen.

Distribution. Found throughout the higher portions of the Southern Syhádri or Western Gháts from the Wynaad to Cape Comorin, not descending below 2500 or 3000 feet elevation. Common on the Nilgiri, Palnai, and Animalé hills. Not known on the Shevrai (Shevaroy) or other ranges east of the Syhádri.

Habits. This animal is shy and wary, the result of human persecution. It inhabits the sholas or dense but abruptly-limited woods of the Nilgiris and other high ranges of Southern India, and is also found in the forests on the slopes of the hills, usually in small troops of from five to ten individuals. It is very noisy, having a loud guttural alarm cry, used also to express anger, and a long loud call. Jerdon relates that when the sholas of the Nilgiri range were beaten for game, these monkeys made their way rapidly and with loud cries to the lowest portion and thence to a neighbouring wood at a lower level.

In consequence of the beauty of their skins, and the circumstance that certain castes eat their flesh, these monkeys are more frequently shot than most of the Indian species, hence their shyness.

17. **Semnopithecus cephalopterus.** *The purple-faced Monkey.*

Cercopithecus vetulus, *Erxl. Syst. Reg. An., Mam.* p. 25 (1777), *partim.*
Cercopithecus kephalopterus, *Zimm. Geog. Gesch.* ii, p. 185 (1780).
Cercopithecus leucoprymnus, *Otto, Acad. Cæs. Leop. Nova Acta*, xii, p. 505, pl. xlvi bis (1825).
Presbytis cephalopterus, *Blyth, J. A. S. B.* xvi, pp. 734, 1271; *Kelaart, Prod.* p. 1; *Blyth, Cat.* p. 13.
? Presbytis thersites, *Elliot, Blyth, J. A. S. B.* xvi, p. 1271, pl. liv, f. 3; *Blanford, P. Z. S.* 1887, p. 626.
Semnopithecus cephalopterus, *Schlegel, Mon. Singes Mus. P.-B.* p. 51; *Anderson, An. Zool. Res.* p. 22; *id. Cat.* p. 43.
Semnopithecus kelaarti, *Schlegel, l. c.* p. 52.

Kallu Wanderu (and *Elli Wanderu*?), Cingalese.

Hair of crown directed backward, not radiating. Whiskers very long, concealing the lower part of the ears. Black supra-orbital hairs but moderately developed. Hair of body of moderate length.

Colour. Body and limbs dusky or smoky brown to black, more or less tinged with ashy grey above and below; sacral region, comprising the lower back, posterior upper portion of thighs, and base of tail, ashy grey to greyish white, greater portion of tail darker grey, tip again paler. Hair uniformly coloured, sometimes paler towards the base, and frequently with pale tips on the back. Crown of head and nape hair-brown, much paler than the back; sides of head and chin ashy grey or white, the long whitish whiskers contrasting strongly with the brown crown, and serving at all ages to distinguish this species from *S. johni*.

Dimensions. Head and body 20 inches, tail 24½. A female skull scarcely adult is 2·5 inches in basal, 3·5 in extreme length, and 2·6 broad.

Varieties. The prevalent coloration, in adults at all events, is nearly black on the body, with the sacral region silvery grey. But in the form named *S. kelaarti* by Schlegel, which appears to be far from uncommon, the whole animal is hair-brown except the lower back, upper portion of thighs, whiskers, and chin, which are light brown or whitish. It is not known whether, specimens thus coloured are ever fully adult, but many immature specimens have the normal coloration. Examples intermediate in coloration between the black and brown forms are also met with. It is probable that the *S. thersites* of Blyth and Kelaart may have been founded on such brown examples of the present species.

It is clear that this monkey varies greatly in coloration, and although at present I am disposed, chiefly for want of accurate information, to keep the two next species, *S. senex* and *S. ursinus*, distinct, it is quite possible that Anderson (Cat. Mam. I. M. pp. 44, 45) may be right in classing all as varieties of *S. cephalopterus*.

The skulls of this species, of *S. johni*, and *S. ursinus* are said by Anderson to be very similar to each other.

Distribution. Found throughout most parts of Ceylon at low or moderate elevations, not above 1300 feet according to Kelaart. According to Layard it is the common monkey of the maritime provinces and is also found in the Kandyan districts.

Habits. Very similar to those of other species, found usually in troops of ten to fifteen individuals. In confinement it is said to be very gentle.

18. **Semnopithecus senex.** *The white Monkey.*

? Simia veter, *L. Syst. Nat.* ed. xii, i, p. 36 (1766).
Cercopithecus senex, *Erxl. Syst. Reg. An., Mam.* p. 24 (1777).
Presbytis albinus, *Kelaart, Prod.* p. 7; *id. J. A. S. B.* xx, p. 182.
Semnopithecus senex, *Schleg. Mus. Pays-Bas*, i. p. 53.
Semnopithecus cephalopterus, var., *Anderson, An. Zool. Res.* p. 23, note; *id. Cat.* p. 45.

Fur dense and wavy, whiskers full. Long white hairs over the toes.

Colour. Yellowish white, faintly marked with brownish on the head, dusky over the shoulders and on the middle of the back. Face and ears black. Soles and palms flesh-coloured.

Dimensions. Apparently the same as those of *S. ursinus*.

Distribution. Mountains of Southern Ceylon at considerable elevations.

Habits. This species or variety is said to be rare, but to be found occasionally on the Ceylonese mountains in parties of three or four, always apart from the other monkeys. Its occurrence was mentioned more than two centuries ago by Captain Robert Knox.

Although it is very possible that *S. senex* is simply a white variety of *S. ursinus* or *S. cephalopterus*, it appears equally probable that the present species may be an allied but distinct form now verging on extinction. The only specimen I have seen, a young animal in the Leyden Museum, looked somewhat different from both. I have not been able to compare the skull.

19. **Semnopithecus ursinus.** *The bear Monkey.*

Presbytis ursinus, *Blyth, J. A. S. B.* xx, pp. 155, 182; *id. Cat.* p. 13; *Kelaart, Prod.* p. 2.
Semnopithecus ursinus, *Anderson, An. Zool. Res.* p. 24.

Maha Wanderu, Cing.

Hair very long, 4 to 5 inches in length on the sides. Supraorbital black hairs scarcely longer than those of crown, but coarser.

The skull is said by Anderson to be shorter, with a greater zygomatic breadth than that of *S. cephalopterus*; the face shorter, and the nasals somewhat longer, besides other distinctions; but it would be necessary to examine more specimens before concluding that these distinctions are constant.

Colour. Dusky brown almost throughout; hair on sides of face and chin paler, greyish brown to white. Hands and feet dark or black; head above in some specimens more rufous than back, and occiput grey. No grey tinge in the sacral region.

Dimensions. Larger than *S. cephalopterus*. Head and body 21 inches, tail 26, hand 5, foot 6½.

Distribution. Mountains of Southern Ceylon, especially near Newera Ellia.

Habits. According to Kelaart, these monkeys are usually seen in large numbers jumping on the trees, and when disturbed make a short howling noise. Sir E. Tennant says that "at early morning, ere the day begins to dawn, their loud and peculiar howl, which consists of quick repetition of the sound *how-how*, may be frequently heard in the mountain jungles." One of these animals has been known to attack a coolie carrying a rice-bag. The flesh of this monkey, as of *S. johni*, is eaten by certain castes of natives.

20. **Semnopithecus pileatus.** *The capped Monkey.*

Semnopithecus pileatus, *Blyth, J. A. S. B.* xii, p. 174 (1843), xiii, p. 467; *Anderson, An. Zool. Res.* p. 13; *id. Cat.* p. 40.
Presbytis pileatus, *Blyth, J. A. S. B.* xvi, p. 735; *id. Cat.* p. 12; *id. Mam. Birds Burma*, p. 11.

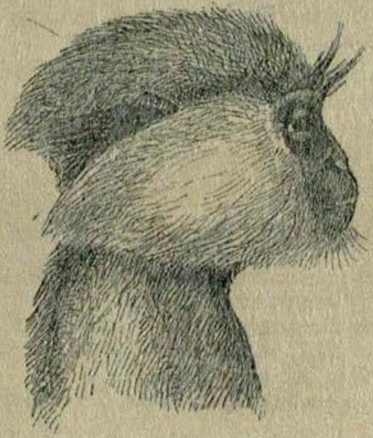

Fig. 9.—Head of *Semnopithecus pileatus.*

The crown of the head thickly covered with hair of equal length, rather longer than that of the occiput and temples and harsher than that of the back, all directed backwards and forming a distinct cap. There is no frontal radiation. Hair of cheeks long, partially covering the ears. Black supraorbital hairs well developed.

Colour. Upper parts dusky grey to brownish ashy grey, darker on the upper part of the back and sometimes on the crown of the head; the hands and feet dark brown or black above, the fingers or some of them occasionally yellow; tail dark brown or black towards the tip. Sometimes the upper parts have a ferruginous tint. Lower parts and sides of head and neck golden brown or orange to pale yellow or yellowish white. The yellow or whitish colour of the cheeks extends to a line drawn just above the ears, and the sides of the neck behind the ears are also pale, so that the dark cap is well defined. Face black.

Blyth states that females and young have the lower parts white or but faintly tinged with ferruginous and the upper parts pure grey, whilst old males are of a deep rust-colour below and on the cheeks. In most specimens, however, the lower parts are of some shade of yellow, more or less pure.

Dimensions. Less than *S. entellus.* An immature female measured:—head and body 18 inches, tail without the tuft of hair at

GSL

the end 28·5, with the tuft 31 (*Blyth*). According to Anderson the skull is of about the same size as that of *S. priamus*, but the supraorbital ridge is less developed.

Distribution. Throughout Assam and the hills to the south of the valley, Sylhet, Tipperah, Chittagong, Northern Arakan, and part of Upper Burma. Neither this nor any other species appears yet to have been recorded from the Himalayas north of Assam. Anderson gives Tenasserim also as a locality, but this is due to his uniting *S. chrysogaster* with this species.

Habits. Nothing is known of the habits of this species in particular, though it doubtless resembles its allies in most respects. In captivity it is said to be gentle when young; but older animals, especially males, are sometimes savage.

21. **Semnopithecus chrysogaster.** *The red-bellied Monkey.*

Semnopithecus potenziani, *Bonaparte, Comptes Rendus*, xliii, p. 412, note (1856), description insufficient.
Semnopithecus chrysogaster, *Licht.*, *Peters*, *P. Z. S.* 1866, p. 429, footnote; *id. MB. Akad. Berlin*, 1879, p. 830, footnote, pl. iv *b* (no description, but a good figure).
Presbytes chrysogaster, *Blyth*, *Mam. Birds Burma*, p. 10.

In the only specimen known there is a slight compressed crest extending from the vertex to the nape, but there is some doubt as to whether this crest is natural; probably it is. No distinct whisker-tufts. Chin thinly covered with short white hairs and a few on the upper lip. Fur of body rather long.

Colour. Upper parts, limbs, and tail jet-black, the basal half of the dorsal hairs ferruginous, the extreme base white; the frontal band, the cheeks to behind the ears, sides and front of neck, with chin and upper breast, white; rest of lower parts deep and bright ferruginous, which tinges the inner side of the limbs.

Young wholly rufous white or pale isabelline.

Dimensions of stuffed adult specimen (a female): head and body 20 inches long, tail 23.

Two specimens, an adult female and a young one, are preserved in the Berlin Museum. According to Blyth, these were obtained by Helfer in Tenasserim. Peters says nothing of Helfer, nor could I learn anything in Berlin of the original collector of the specimens, although on the stand, besides the locality, is the name Prof. Strempel. The circumstance that so beautifully coloured and conspicuous a species has not been noticed again tends to raise some doubt as to the species really occurring in Tenasserim. At the same time, *Sciurus piceus*, said by Peters (P. Z. S. 1866, p. 429, note) to have been received with *Semnopithecus chrysogaster*, appears to be identical with a variety of *Sciurus erythræus* that occurs in Cachar.

GSL

22. **Semnopithecus barbei.** *Barbe's Leaf-Monkey.*

Presbytis barbei, *Blyth, J. A. S. B.* xvi, p. 734; *id. Cat.* p. 14; *id. Mam. Birds Burma*, p. 11.
Semnopithecus barbei, *Anderson, An. Zool. Res.* p. 12; *id. Cat.* p. 48.

No crest. Hair on the crown not radiating. Whiskers long. Beard short. Hair on the vertex slightly lengthened, but not so distinctly as in *S. obscurus*.

Colour. Blackish brown to black above and below, with a silvery greyish wash on the upper parts and outside of limbs. Eyebrows and whiskers black. Naked face bluish black.

Dimensions. Head and body 19·5 inches, tail 29.

Distribution. The types were from the interior of the Tipperah hills. This species has also been obtained by Anderson on the Irawadi just above Mandalay in Upper Burma, and further north in the Kakhyen Hills, and by Mr. Ossian Limborg on Muleyit mountain west of Moulmain in Tenasserim. Mr. Limborg's specimens have been identified by Dr. Anderson, but require comparison with the monkey from the same neighbourhood identified as *S. phayrei* by Colonel Tickell.

Habits. Similar to those of other members of the genus. Anderson observed this monkey in parties of from thirty to fifty. They were not shy.

It is possible that this species, of which I have not been able to examine specimens, is only a variety of *S. obscurus*. This was Blyth's view at one time (J. A. S. B. xxiv, p. 711), and Anderson (*l. c.*) has shown that there is much similarity in the skulls of these two forms. Both have rounded orbits and a comparatively elongate interorbital region. Blyth, in his Catalogue and in his list of Burmese Mammals, however, classed *S. barbei* as closely allied to *S. femoralis*, if not identical. This scarcely appears to me borne out by the description.

23. **Semnopithecus phayrei.** *Phayre's Leaf-Monkey.*

Semnopithecus obscurus, *Blyth, J. A. S. B.* xiii, p. 466, *nec Reid.*
Presbytis phayrei, *Blyth, J. A. S. B.* xvi, p. 733 (1847); *id. Cat.* p. 15.
Semnopithecus argentatus, *Blyth, Horsfield, Cat.* p. 7.
Presbytis cristatus, *Raffles, apud Blyth, Mam. Birds Burma*, p. 9, *nec Raffles.*
Semnopithecus phayrei, *Anderson, An. Zool. Res.* p. 34; *id. Cat.* p. 49.

Myouk-myek-kweng-hpyu (monkey with white orbits), Burm.; *Myouk-hgnyo*, Arakan and Tavoy; *Geng*, Talain; *Dáthwa* and *Shawá me*, Karen.

A somewhat peaked, longitudinal median crest on the vertex. Hair of crown elongated, directed backwards, not radiating. Whiskers long, partly covering the ears. In the skull the supraorbital ridges are but little developed, and the orbits are less rounded than in *S. barbei* and *S. obscurus*. The occipital region is nearly vertical.

Colour. Above dark ashy brown, darkest on the head and extremities, including the tip of the tail, the basal portion of which is albescent. Back from shoulders to loin silvery, or glistening. Whiskers same colour as crown. Underparts whitish or white, this colour not extending on to the limbs. Eyelids and a broad area above the eyes whitish or white; an area including the mouth and lips, and extending from the nostrils to the chin, flesh-colour; hairs around mouth white; remainder of face leaden black.

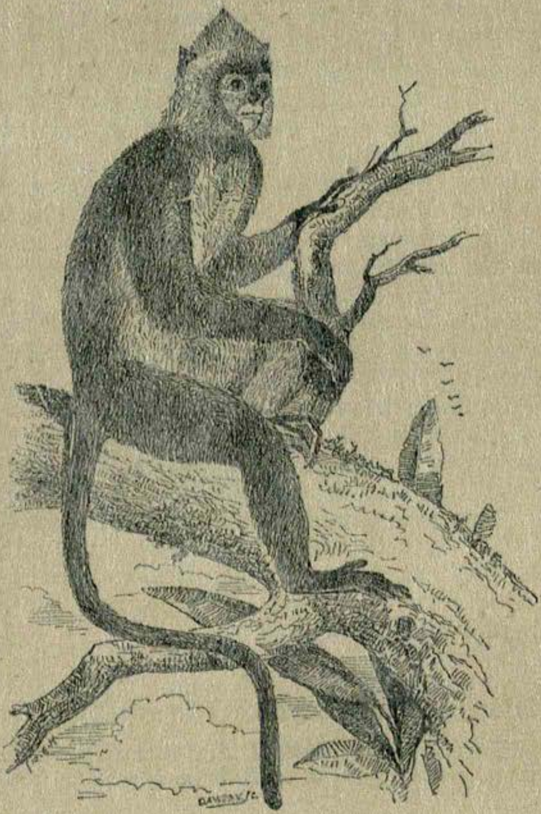

Fig. 10.—*Semnopithecus phayrei.* (From a drawing by Col. Tickell.)

Young the same colour as adults; the very young are, however, straw-coloured according to Tickell.

Dimensions. An adult female, according to Tickell, measured: head and body 23 inches, tail 30, hand 4¾, foot 6. Anderson gives much smaller measurements: head and body 18·2 inches, tail 21·2.

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Distribution. Arakan, the Bassein district of Pegu west of the Bassein river, where I shot this monkey myself, and Northern Tenasserim, near Moulmain, where the same species apparently was obtained by Tickell (J. A. S. B. xxviii, p. 428, and MS. notes) and by Mr. W. Davison.

In Tickell's unpublished notes there is an excellent coloured drawing and description with several details of anatomy &c., taken from an adult female that he obtained east of Moulmain. The drawing, from which the accompanying cut is taken, represents an animal greyer in colour than Arakan specimens, and the hands and feet are blackish above, contrasting strongly with the colour of the limbs. The lower parts are white on the lower abdomen and inside the thighs only; elsewhere they are ashy grey. This animal may have been an example of *S. albocinereus*, Desm. (*S. siamensis*, Müll. & Schl.), but I am rather disposed to refer that species to *S. femoralis*.

Habits. Phayre's Leaf-Monkey is found in dense high forests, or amongst bamboos on the hill-sides and on the banks of streams, usually in flocks of twenty or thirty individuals. It is very shy and wary, and is consequently more often heard than seen, the whole flock when alarmed rushing through the forest, shaking the branches violently and leaping from tree to tree. But occasionally, as Tickell observes, an old male stays behind in a safe post of vantage on the top of one of the highest trees, where he may be heard uttering his short deep alarm-cry at frequent intervals. This cry is an angry bark not unlike that of the Hanúmán. I was once well scolded from a tree by an old monkey, I believe of this species, on the edge of a half-deserted clearing in Southern Arakan. I had done nothing to offend his monkeyship, but he evidently considered me as something unusual and suspicious. Blyth observes that the young of this species, besides making a whining noise to express their wants, emit a cry that might be mistaken for the mew of a cat.

24. **Semnopithecus obscurus.** *The dusky Leaf-Monkey.*

Semnopithecus obscurus, *Reid, P. Z. S.* 1837, p. 14 (no description); *Anderson, An. Zool. Res.* p. 25; *id. Cat.* p. 46; *Thomas, P. Z. S.* 1886, p. 66.

Presbytis obscurus, *Blyth, Cat.* p. 14; *id. Mam. Birds Burma*, p. 10.

Lotong or *Lotong-itam*, Malay.

Hair of crown directed backwards, not radiating, becoming lengthened at the back, so as to form a pointed projecting tuft on the occiput. Whiskers long.

Colour. As a rule dark ashy grey on the head, body, and limbs, varying, however, to blackish brown; feet and hands black; lower parts rather paler; tail as a rule lighter than the body. The lengthened hair on the occiput conspicuously paler, sometimes whitish. The nape and sometimes the middle of the back often brownish. Mouth and eyelids whitish, remainder of face black.

A female obtained by Mr. Davison at Bánkasún, in the extreme south of Tenasserim, has the crown of the head and middle of the back hair-brown, sides almost black; long hair of occiput, limbs, tail, and underparts brownish grey; feet black above, as usual.

The young are of a vivid golden ferruginous colour, which soon changes to dusky ash, the rufous colouring remaining longer on parts of the head, throat, flanks, and thighs, and longest of all on the terminal portion of the tail. Probably the female described above retained the coloration of the young on the limbs and tail.

Dimensions. In an adult male the head and body measured 21 inches, tail 32. An adult male skull from Tenasserim* in the British Museum measures in extreme length 4·25, basal length 3, and zygomatic breadth 3·5. In an adult female skull the corresponding dimensions are 3·8, 2·7, and 2·85 inches.

Distribution. Malayan Peninsula, Siam, and the Tenasserim provinces.

25. **Semnopithecus femoralis.** *The banded Leaf-Monkey.*

Semnopithecus femoralis, *Horsfield, Appendix Life Sir T. S. Raffles,* p. 642 (1830) (no description); *Martin, Charlesworth's Mag. N. H.* ii, p. 436 (1838); *Cantor, J. A. S. B.* xv, p. 175; *Horsf. Cat.* p. 10; *Anderson, An. Zool. Res.* p. 30; *id. Cat.* p. 52; *Thomas, P. Z. S.* 1886, p. 66.

Two distinct radiating centres, one on each side of the forehead behind the supraorbital ridge. Hair of the occiput elongate, forming a crest as in *S. obscurus.*

Colour. Blackish brown to black, except upon a varying portion of the under surface, which is white, and always includes the lower abdomen and inside of the thighs. Sometimes the latter colour extends only to the knee, in other specimens it passes down the inside of the leg to the heel, and also occupies the centre of the chest, the inside of the arm, and the lower surface of the tail except near the tip.

Dimensions. Anderson gives head and body 19 inches, tail 22; but no measurements from fresh individuals are available.

Distribution. Borneo, Sumatra, and the Malay Peninsula, extending north into Tenasserim. A specimen was obtained by Mr. Davison at Bánkasún in South Tenasserim.

Nothing is recorded of the habits of this species.

I am strongly disposed to suspect that *S. siamensis,* Müll. & Schleg. (*S. albocinereus* apud Cantor), is a grey form of this species.

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* This is one of a large collection of Indian skulls in the British Museum labelled as presented by the late Dr. Oldham. The collection was made by Mr. W. Theobald, and entrusted by him to Dr. Oldham for presentation to the Museum.

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Suborder *LEMUROIDEA.*

The Lemurs or Half-Apes, *Prosimiæ* of some authors, differ so widely from the Monkeys, both externally and anatomically, as to have been classed by many naturalists in a distinct order. The principal distinctions are the form of the skull and teeth, the greater extent to which the cerebellum is uncovered by the cerebrum, the greater development of the pollex, and the long claw-shaped nail on the second digit of the foot in Lemurs, and the presence in these animals of a perforate clitoris, a two-horned uterus, and a bell-shaped, diffuse, and non-deciduate placenta. The skull in Lemurs has a long narrow muzzle; the orbits are not surrounded by bone behind, as in Monkeys, but open freely beneath the bony orbit into the temporal fossa; and the lachrymal foramen, instead of being internal, opens on the outside of the skull. The upper incisors are, in nearly all Lemurs, divided by a toothless interspace in the middle of the upper jaw; and the lower incisors are long, narrow, and projecting; whilst the lower canines are, in most of the forms, only distinguished from the incisors by greater depth, and have been, by several writers, counted as incisors. In most species, too, the anterior or first lower premolar is larger than the second and third, and resembles a canine, whilst the other premolars and molars are very different in shape from those in all the Old-World Monkeys (those of the Marmosets are intermediate in form), being more or less ovate in section instead of rectangular. Most of the characters enumerated as distinguishing the Lemurs are found also in other and lower orders of Mammalia. (For additional details on the *Lemuroidea*, see Mivart, P. Z. S. 1873, p. 503, and 'Encyclopædia Britannica,' article "Lemur.")

The *Lemuroidea* are divided into three families—*Lemuridæ*, comprising the greater number of the genera; *Tarsiidæ*, consisting of a single genus and species, *Tarsius spectrum*, found in the Malay Archipelago, but not known to occur on the continent of Asia; and *Chiromyidæ*, also comprising a solitary representative only, the Aye-Aye of Madagascar. The first family is alone represented in South-eastern Asia.

Family LEMURIDÆ.

Two genera occur within our area, all the others are restricted to Africa and Madagascar, the majority being peculiar to the last-named island. The two found in India, Ceylon, and Burma are thus distinguished:—

I. Either only two upper incisors, or four of unequal size; the inner pair much larger than the outer. Tail present, but very short. Limbs not remarkably slender....................................	NYCTICEBUS.
II. Four small upper incisors of equal size. Tail none. Limbs very slender....................................	LORIS.

The lemurs of the Oriental region afford one of the most remarkable and interesting examples of geographical distribution known. The nearest allies of *Nycticebus* and *Loris* are two genera, *Perodicticus* and *Arctocebus*, found only in West Africa. *Nycticebus* has an extensive range east of the Bay of Bengal, but has not been recorded from the Himalayas; *Loris* is peculiar to Southern India and Ceylon.

Genus **NYCTICEBUS**, Geoffroy, 1812.

Syn. *Stenops*, v. d. Hoeven.

Head short; limbs moderately stout; body slender; tail very short; ears short, rounded, and covered with hair; eyes large and approximate; second digit of both hand and foot very short, that of the foot with a long claw, all the other digits with a broad nail.

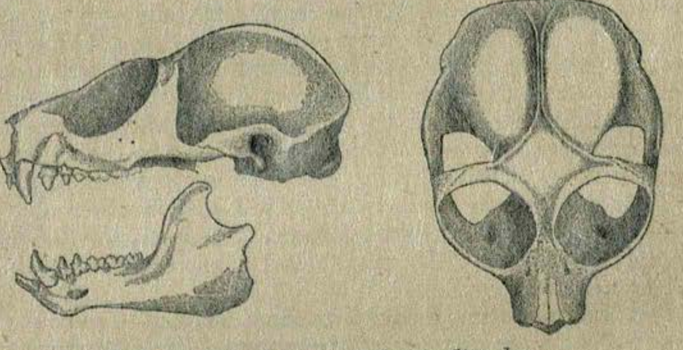

Fig. 11.—Skull of *Nycticebus tardigradus*.

The skull is globular behind; the muzzle produced, but not very narrow anteriorly; orbits large. The greatest breadth of the skull is across the zygomatic arches. Vertebral formula: C. 7, D. 16–17, L. 6–8, S. 3, C. 11–12.

Dentition: i. $\frac{1-1}{4}$ or $\frac{2-2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$. When there are two pairs of upper incisors, the inner are much larger than the outer. The last upper molar has but three well-developed tubercles, two outer and one inner.

26. **Nycticebus tardigradus**. *The slow Loris.*

Lemur tardigradus, *L. Syst. Nat.* p. 44 (1766), excl. syn.
Nycticebus bengalensis, *Geoffr. Ann. Mus.* xix, p. 164 (1812).

GSL

Nycticebus tardigradus, *Blyth, Cat.* p. 18; *Jerdon, Mam.* p. 14; *Anderson, Cat.* p. 94.
Nycticebus cinereus, *A. Milne-Edw. Nouv. Arch. du Mus.* iii, 1867, *Bull.* p. 11, pl. 3; *Anderson, An. Zool. Res.* p. 103; *id. Cat.* p. 94.

Sharmindi billi (bashful cat), H.; *Lajjar* or *lajjawoti bánar* (bashful monkey), Bengali; *Myouk-moung-ma* (monkey's concubine), Burmese; *Myouk hlioung*, Tavoy; *Kasyng*, Talain; *Tacheng*, Karen; *Kúkang* and *Bruh-samúndi*, Malay.

Fur very close and woolly, covering the whole body and face with the exception of the nose and lips. The short hairy ears and the short tail are almost concealed beneath the fur. As a rule, there are four incisors in the upper jaw, but one or both of the outer pair may be wanting.

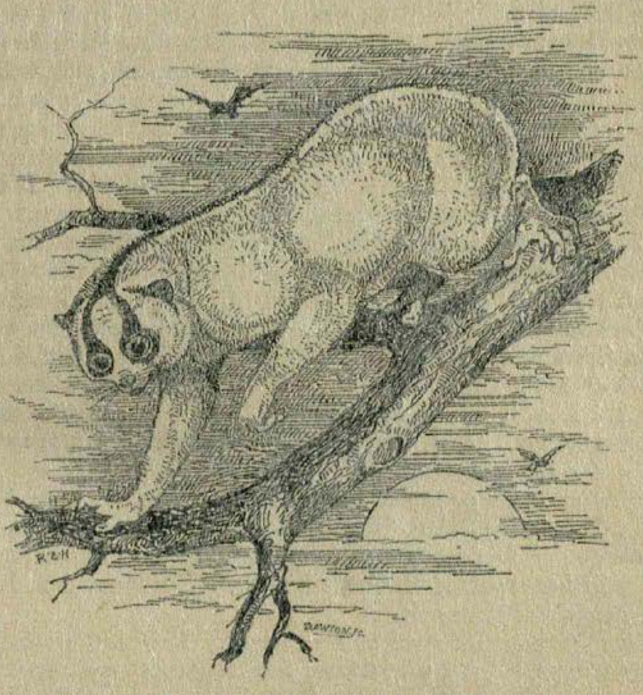

Fig. 12.—*Nycticebus tardigradus*, Tenasserim variety.
(From a drawing by Col. Tickell.)

Colour. There are two principal varieties, differing in colour and somewhat in size, found in the countries east of the Bay of Bengal. The more common and larger of the two is that called *N. bengalensis* by Geoffroy, and *N. cinereus* by A. Milne-Edwards, and is the var. A of Blyth's Catalogue. This is ashy grey above, and rather paler below, more or less silvery on the back, and often rufescent on the rump, the fur being dark ashy at the base. A

GSL

chestnut-brown stripe runs down the back from the crown to the loins, but does not expand into a broad patch on the crown. Each eye is surrounded by a dark brown circle, broadest above; a narrow space in front between the two orbital rings is whitish or white. A small oval patch, including each ear, is also brown. Nose and soles of feet flesh-coloured where naked.

The other variety is, as a rule, smaller and rufescent grey above, paler below; the dorsal stripe is broader, and often deep rich brown: it usually expands into a broad rufous expanse on the crown, including the ears but not the eyes, which are always surrounded by a brown ring.

A third form is figured from Tenasserim by Tickell, from whose drawing the accompanying cut is taken. In this, which is pale rufescent, the dorsal stripe simply bifurcates on the forehead, one band running to the circle round each eye.

This leads to the type known as *N. javanicus*, in which there are four brown bands running down the head and face from the crown, one to each eye and one to each ear; the interspaces pale, and those between the eyes white. This variety, or race, is said to be peculiar to Java, and rather smaller in size than the others, and to have almost constantly only two upper incisors. Schlegel, too, states that it has eight lumbar vertebræ instead of six. It is very doubtful, however, if any of these distinctions are constant.

Dimensions. An adult male from Upper Burma, according to Anderson, measured: head and body 13·2 inches long, tail 0·75, fore limb and foot 7·2, hind limb 9. Jerdon gives a greater length, 14·5 to 16 inches. All these are taken from the large northern variety. A Tenasserim adult male, measured by Tickell, was 12·75 inches long. Two adult skulls measure 2·5 and 2·65 inches in extreme length, 2·2 and 2·3 in basal length, 1·7 and 1·8 broad across the zygomatic arches. A Javanese skull is only 2·15, 1·85, and 1·55 inches in the three dimensions.

Distribution. Throughout the countries east of the Bay of Bengal—Burma, Malacca, Siam, and the islands of Sumatra, Java, and Borneo. Common in Assam, Sylhet, &c., and extending west to the neighbourhood of Rangpur and Dacca, but not found in the Himalayas.

Habits. Purely nocturnal and arboreal. This animal feeds on leaves and shoots of trees, fruits, insects, birds' eggs, and young birds. It has been observed by Tickell to raise itself on its hind legs and throw itself upon an insect. As a rule it is silent, or only utters a feeble crackling sound, but when angry and about to bite it emits a tolerably loud growl or grunt. When captured, it is at first apt to be savage and prone to bite, but soon becomes very gentle and docile.

Tickell, from whose MS. the above notes are chiefly derived, says:—"This animal is tolerably common in the Tenasserim provinces and Arakan, but, being strictly nocturnal in its habits, is seldom seen. It inhabits the densest forests, and never by choice leaves the trees. Its movements are slow, but it climbs readily,

GSL

and grasps with great tenacity. If placed on the ground, it can proceed, if frightened, in a wavering kind of trot, the limbs placed at right angles. It sleeps rolled up in a ball, its head and hands buried between its thighs, and wakes up at the dusk of evening to commence its nocturnal rambles. The female bears but one young at a time."

Genus **LORIS**, Geoffroy, 1796.

Head short; nose narrow; body slender; limbs very slender and long; tail wanting; ears larger than in *Nycticebus*, rounded, and naked towards the margin; eyes very large and close together.

Skull with orbits that are very close together, merely separated by a very thin bony plate, and so large that the breadth across the orbits is greater than that across the zygomatic arches; muzzle narrow anteriorly. Vertebræ: C. 7, D. 15, L. 8, S. 3, C. 6–8.

Dentition: i. $\frac{2-2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$. The upper incisors all small and of equal size. Hindmost upper molar with four well-developed tubercles.

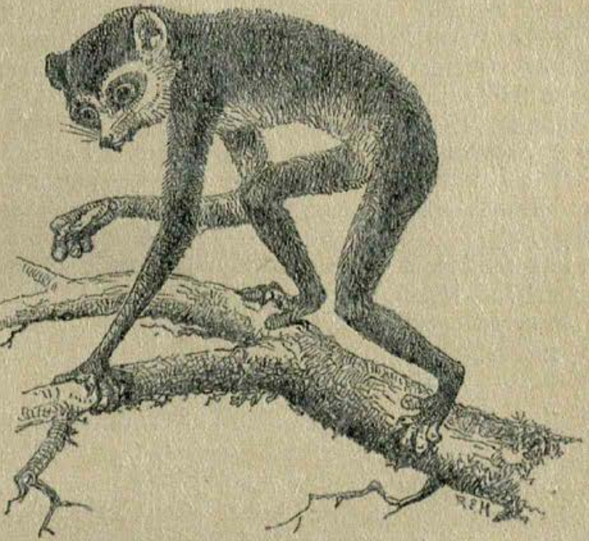

Fig. 13.—*Loris gracilis.*

27. **Loris gracilis.** *The slender Loris.*

Loris gracilis, *Geoffr. Magasin Encyclopédique*, An 4ᵉ (1796), t. i, p. 48; *Blyth, Cat.* p. 19; *Jerdon, Mam.* p. 15; *Anderson, Cat.* p. 97.

Stenops gracilis, *Kelaart, Prod.* p. 9.

Devánga-pilli, Tel.; *Tevángu*, Tam.; *Nala* and *Adavi-manushya*, Can.; *Chinge-Kuli*, Kurg; *Una happolava*, Cing.

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Fur very close, soft, and rather woolly; ears thin, rounded, naked towards the edge, of moderate size, considerably larger and more conspicuous than in the slow Loris.

Colour. Dark earthy grey, more or less rufescent above and on the outside of the limbs, often with a silvery wash. Dorsal fur whitish (occasionally ashy near the skin), with a blackish ring near the end and white tips. Lower parts much paler. Some specimens of the young are much more rufous, almost ferruginous. A narrow white stripe between the eyes expanding into a broader area on the forehead; sides of face, including the eyes, darker.

Dimensions. Length of head and body about 8 inches, arm 5, leg 5·6. Skull of an adult 2 inches long from occiput to end of nasal bones, which project beyond the premaxillaries; basal length 1·5; breadth 1·25 across the orbits, 1·2 across the zygomatic arches.

Distribution. Southern India and Ceylon, in the lowland forests, not, so far as is known, at any considerable elevation above the sea. This species does not appear to have been recorded as far north as the Godavari valley. It may probably be found on the West coast of India, in the Southern Concan, near Ratnagiri, but even this is not clearly ascertained. According to Jerdon, it appears to be rare on the Malabar coast, but common in the forests of the "Eastern Gháts" (probably the hills south of the Kistna river).

Habits. Very similar to those of *Nycticebus tardigradus*, except that the slender Loris is rather quicker in its movements, though still slow in general. Like its ally, it is purely nocturnal and arboreal; living upon shoots and young leaves, insects, birds' eggs, birds, and lizards. It is said to be very fond of honey or syrup. It sleeps rolled up in a ball with its head between its legs, grasping its perch with its arms.

According to Jerdon, numbers are occasionally brought to the Madras market. The eyes are a favourite remedy of the Tamul doctors for certain eye-diseases.

49 CSL

Order CARNIVORA.

Whether the members of the great group of flesh-eating Mammals, comprising cats, civets, ichneumons, hyænas, dogs, weasels, badgers, otters, racoons, bears, seals, and their allies, are structurally inferior to the Primates or not, is a question on which some difference of opinion exists; but there can be no question as to the superiority of organization shown by the higher Carnivora when compared with any other mammalian order, except that containing Man and the anthropoid Apes. The superiority is quite as well marked in the development of the brain as in that of the body and limbs.

The Carnivora are animals with never less than four toes on each foot, all the toes being armed with claws. The pollex and hallux are never opposable. The teeth comprise incisors, canines, and molars. The incisors are, with very few exceptions, three on each side of each jaw—the outer, especially in the upper jaw, being larger than the others. The canines are well developed. There is a milk-dentition. The condyle of the lower jaw is a transverse half-cylinder, working in a glenoid fossa of corresponding form, hence the movement of the jaw is only up and down, not lateral. The stomach is simple. The cæcum is short or absent. The uterus is bicornuate; the placenta deciduate, and often zonary. The mammæ are abdominal. The clavicle is often absent, and when present imperfect. In many forms there is a bony septum inside the skull, between the cerebrum and cerebellum.

There is but little difference of opinion amongst naturalists as to the limits of the Carnivora; the only point on which the agreement is imperfect is as to whether the seals should be included in the order or classed separately. When they are included, as in the system here followed, they form a separate suborder, called *Pinnipedia*, distinguished by having the whole external form modified for an aquatic life, the hind feet especially being converted into paddles. The teeth of the molar series, both premolars and molars, are similar to each other in size and form. Nearly all seals inhabit cold climates, and none are found in India or the neighbouring countries. The *Carnivora vera* or *Fissipedia* are fitted for a terrestrial or partially terrestrial life, and have the teeth of the molar series in each jaw dissimilar in size and form, there being always one tooth on each side, above and below, that is especially modified, and that is, in the majority of the families, larger than the other teeth: this is the sectorial, carnassial, or flesh-tooth.

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The teeth in front of it are more or less sharp, pointed, and compressed; those behind are broad and tuberculated. The sectorial in the upper jaw is the hindmost premolar, and consists of a more or less compressed bicuspid or tricuspid crown on two roots and an inner lobe supported by a third root. In the *Ursidæ*, in which the sectorial teeth are ill-developed, the inner lobe and root are wanting. The lower sectorial is the first true molar, and consists of two roots supporting a bilobed compressed crown, with, in general, a keel and an inner tubercle; both of which, however, are wanting or rudimentary in the most specialized *Carnivora*, as the *Felidæ*.

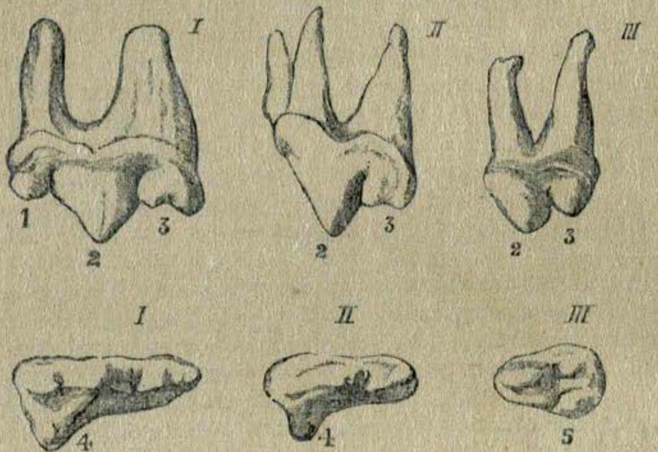

Fig. 14.—Upper sectorial teeth of I. *Felis*, II. *Canis*, III. *Ursus*. (Flower, Art. Mammalia, 'Encyclopædia Britannica.').—1, anterior, 2, middle, 3, posterior cusp of blade; 4, inner lobe supported on distinct roots; 5, inner lobe posterior in position, and without distinct root, characteristic of the *Ursidæ*.

Suborder *FISSIPEDIA*.

As already mentioned, the limits of this suborder (or order according to some writers) are generally admitted; but the subdivision into sections and families is difficult, owing to the complicated relationships between the different genera. The majority live entirely upon animal food; but a few, like the bears, feed on a mixed diet, of which vegetables form a portion. A considerable number, as the cats and dogs, walk on their toes, and are known as Digitigrade, whilst others, for instance the bears, rest upon their palms (*palma*) and soles (*planta*) and are distinguished as Plantigrade; a somewhat intermediate mode of progression, found in the weasels, otters, and badgers, being termed Semiplantigrade. This distinction has been extensively employed in classification, but is defective, for *Paradoxurus*, *Arctictis*, and *Cryptoprocta* are more or less plantigrade, although in other respects much more nearly

CSL

allied to the digitigrade cats and civets than to any of the plantigrade or subplantigrade Carnivora. Mr. H. N. Turner* and Professor Flower† have proposed to divide the order into three sections, named *Æluroidea*, *Cynoidea*, and *Arctoidea*, from the Greek names of the cat, dog, and bear respectively, each of these animals being typical of a particular section, and the distinctive characters being taken principally from the base of the skull and the development of a cæcum. Some other characters taken from the generative organs support this classification, which is employed in the following table. The accompanying cut of part of a wolf's skull will serve to illustrate the distinctions mentioned, and a dog's or jackal's skull will be found precisely similar in all essential points to a wolf's, and will serve for comparison.

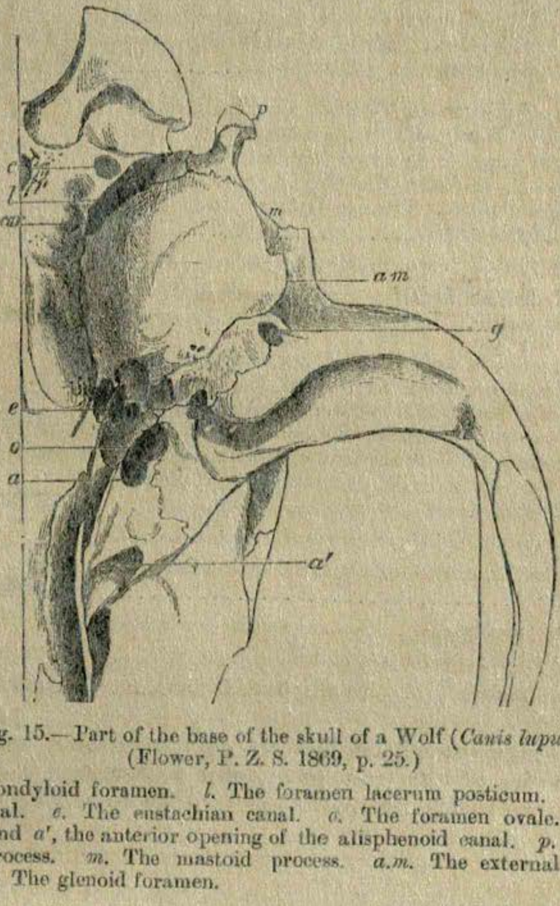

Fig. 15.—Part of the base of the skull of a Wolf (*Canis lupus*). (Flower, P. Z. S. 1869, p. 25.)

c. The condyloid foramen. *l*. The foramen lacerum posticum. *car*. The carotid canal. *e*. The eustachian canal. *o*. The foramen ovale. *a*. The posterior, and *a'*, the anterior opening of the alisphenoid canal. *p*. The par-occipital process. *m*. The mastoid process. *a.m.* The external auditory meatus. *g*. The glenoid foramen.

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* P. Z. S. 1848, p. 86.

† P. Z. S. 1869, p. 4. This paper contains numerous details of anatomy.

A. Auditory bulla much dilated, rounded, and (except in *Hyænidæ*) divided into two chambers by a septum. Bony auditory meatus short. Paroccipital process flattened against the bulla and (except in *Hyænidæ*) not projecting behind. Condyloid and glenoid foramina concealed or wanting. Cæcum small .... **ÆLUROIDEA** *.

  a. Head short; 3 or 4 teeth in upper molar series, 3 in lower; dorsal vertebræ 13; claws sharp, curved, and (except in *Cynælurus*) completely retractile. Toes 5—4 .... 1. **Felidæ.**

  b. Head elongate; 5 or 6 teeth in molar series of each jaw; claws variable. Toes usually 5—5. 2. **Viverridæ.**

  c. Head elongate; 4 teeth in upper molar series, 3 or 4 in lower, all small and widely separated; claws blunt. Toes 5—4 .... **Proteleidæ.**

  d. Head slightly elongate; 5 teeth in upper molar series, 4 in lower; dorsal vertebræ 15; claws blunt, not retractile. Toes 4—4 .... 3. **Hyænidæ.**

B. Auditory bulla much dilated, rounded but not divided. Bony auditory meatus short. Paroccipital process flattened against bulla, but projecting behind. Condyloid and glenoid foramina distinct. Cæcum elongate, and generally folded on itself .... **CYNOIDEA.**

  a. Premolars $\frac{4-4}{4-4}$, true molars variable ($\frac{2-2}{2(3)-2(3)}$ in all Indian forms); claws exserted, blunt, non-retractile. Toes 5—4 (except in *Lycaon*) 4. **Canidæ.**

C. Auditory bulla not rounded nor divided, most prominent on inner border and sloping thence forwards, backwards, and outwards, flattened off towards the meatus, the lower lip of which is prolonged. Paroccipital process prominent, quite free from bulla. Condyloid and glenoid foramina distinct. No cæcum. Toes 5—5 .. **ARCTOIDEA** †.

  a. True molars $\frac{1-1}{2-2}$ (one tubercular molar behind the sectorial above and below). No alisphenoid canal .... 5. **Mustelidæ.**

  b. True molars $\frac{2-2}{2-2}$ (two tubercular molars in upper jaw, one in lower, behind sectorial) .. 6. **Procyonidæ.**

  c. True molars $\frac{2-2}{3-3}$. An alisphenoid canal .... 7. **Ursidæ.**

Of the above-named families one only, *Proteleidæ*, containing a single species, *Proteles cristatus*, peculiar to Southern Africa, is not found in the Indian region. The remaining seven are represented.

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* For anatomical details of classification see Mivart, P. Z. S. 1882, pp. 135, 459.

† For anatomical details see Mivart, P. Z. S. 1885, p. 340.

ÆLUROIDEA.

Family FELIDÆ.

This, the most typical and highly specialized group of flesh-eating mammals, and that to which the term "beasts of prey" is especially applicable, comprises the various kinds of cat, all of which, despite great differences in size, are closely allied and resemble each other in almost all details of structure. In the cat, the whole organism is peculiarly adapted for the capture and killing of other animals for food; the armature of teeth and claws, the power of speed for a short distance, the excessive muscular development and activity, are all combined to enable a feline to seize and kill animals, in some cases, superior in size to itself*.

The cats are distinguished from all other families of *Carnivora* by having a rounder head and more highly specialized teeth; the canines and sectorial, or flesh-teeth, in particular being highly developed weapons for cutting and tearing, whilst the remaining teeth of the molar series are poorly developed. The claws also are adapted for inflicting severe wounds, and are applied to the armature of a foot worked by powerful muscles, and, in the case of the fore legs, with unusual freedom of action, as may easily be seen by comparing the movements of a cat's fore limb with those of a dog's. The vertebræ are C. 7, D. 13, L. 7, S. 3, C. 13–29. There is no alisphenoid canal.

The dental formula in the *Felidæ* is i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{2-2}$ or $\frac{2-2}{2-2}$, m. $\frac{1-1}{1-1}$. The outer incisors are much larger than the others, especially in the upper jaw. The canines have, in many species, a sharp hinder edge. The anterior upper premolar is small, has a single root (except in *F. planiceps*), and is often lost in old skulls, whilst it is always wanting in the adults of some species, as in *F. rubiginosa* and the Lynxes. The second upper premolar is two-rooted, pointed, with a large central lobe preceded by one small cusp and followed by two.* The third upper premolar, the sectorial or flesh-tooth, is by far the largest of the molar series, and bears three roots or fangs, with a crown consisting normally of four lobes, three along the inner margin and an inner lobe, the development of which varies in different species. The hindmost tooth is the true molar, which is small, bears two roots and a flattened crown, and is placed with its longer axis nearly at right angles to that of the premolars. This tooth, like the anterior premolar, is often lost in old animals.

The teeth of the molar series in the lower jaw consist of two premolars, similar in shape, each being, like the second upper premolar, quadricuspid, with two roots, the anterior premolar rather smaller than the other; behind these is the sectorial, or true molar, with two roots and two nearly equal lobes, each ending in a point, the points diverging but connected by a sharp cutting-edge. There is sometimes a rudimentary hinder tubercle or "talon."

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* For a complete account of the cat's anatomy, see Dr. St. George Mivart's work entitled 'The Cat,' published in 1881.

The deciduous or milk-teeth are of course much smaller; but resemble in form the permanent teeth that succeed them, with the exception of the second milk-molar in each jaw and the third in the upper. The second upper milk-molar is three-fanged, and much resembles in form the permanent third premolar or sectorial, whilst the third milk-molar resembles the upper true molar in shape, but is relatively larger. The second lower milk-molar somewhat simulates the lower first true molar or sectorial, but the anterior lobe is smaller than the second, and behind the latter are two posterior tubercles.

The claws are perfectly retractile (partially in *Cynælurus*). The terminal or third phalanx of each digit is attached to the side, not the end, of the second, and is drawn back by a retractor ligament attached to the proximal end of the third phalanx, and passing through a bony sheath on the first phalanx.

All cats are truly digitigrade. The pollex, or thumb, is well developed and has a large claw, but is not used in walking, being more proximally situated than the other digits. There is no hallux. There is a thick pad for each toe, that for the pollex being smaller than the others, and a large median pad between the four toes on each foot. A seventh small pad exists on the fore leg on the outer palmar surface of the metacarpus.

The organs of sight and hearing are well developed and the senses acute. The long vibrissæ, commonly called whiskers, are delicate organs of touch. The tongue is covered with rough papillæ directed backwards, and adapted to remove flesh from bones. The intestines are comparatively short, being from twice to five times the length of the body.

Cats are found in all the Continents, but are wanting in the Australian and Madagascar regions.

The *Felidæ* comprise only two genera, both of which are found in India. They are thus distinguished:—

Claws perfectly retractile; inner cusp of upper sectorial well developed	FELIS.
Claws imperfectly retractile; inner cusp of upper sectorial rudimentary	CYNÆLURUS.

A monograph of the family, with excellent coloured figures of all the species by Wolf, has been published by Mr. D. G. Elliot.

Several forms of fossil *Felidæ* have been discovered belonging to both living and extinct genera. In the Siwaliks of North-western India remains of five species of *Felis*, one of which, *F. cristata*, nearly equalled the tiger in size, have been found, together with those of two forms of the great sabre-toothed feline *Machærodus*, an extinct type with enormous canines, and jaw-fragments indicating two other genera, *Ælurogale* and *Æluropsis*, the latter peculiar to the Indian Pliocene. Some bones of felines have also been found in Indian Pleistocene deposits, but they have not been identified with certainty.

Genus **FELIS**, Linnæus, 1766.

This genus is perhaps represented by more species in India and its dependencies than in any other tract of the earth's surface equal in area.

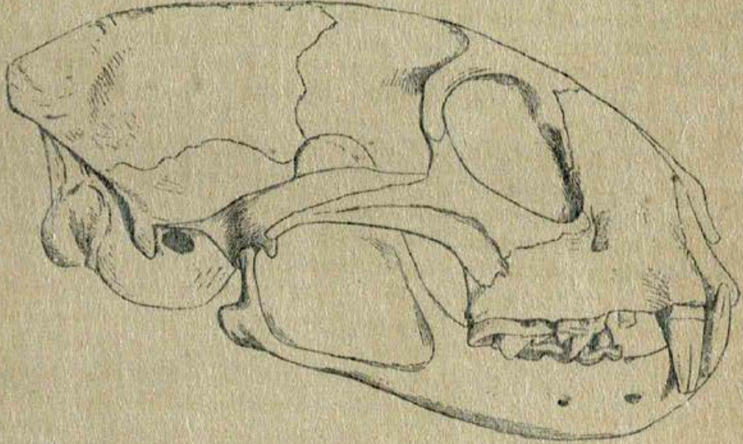

Fig. 16.—Skull of *Felis viverrina*. (Gray, P. Z. S. 1867, p. 268.)

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Ears of moderate length, not tufted, or with short hairs only at the end.
  a. Large, tawny throughout; tail tufted at the end .... *F. leo*, p. 56.
  b. Large, transversely striped; tail not tufted. *F. tigris*, p. 58.
  c. Spotted throughout, spots on body less than 2 inches in diameter.
    a'. Large, exceeding 5 feet from nose to tail-tip .... *F. pardus*, p. 67.
    b'. Less than 5 feet from nose to tail-tip.
      a''. Tail about one fourth of total length (from nose to tail-tip)............ *F. viverrina*, p. 76.
      b''. Tail about one third of total length.
        α. No distinct longitudinal bands on crown; ears pointed .... *F. ornata*, p. 84.
        β. Distinct longitudinal bands on crown; ears rounded.
          α'. Upper molar series 3 on each side; tail unspotted.......... *F. rubiginosa*, p. 81.
          β'. Upper molar series 4; tail spotted above .... *F. bengalensis*, p. 78.
  d. Large spots, exceeding 2 inches in diameter, or irregular blotches on the body.
    a'. Large, pale grey or whitish with dark rings on body .... *F. uncia*, p. 71.

b'. Brownish grey or tawny, with large irregular blotches or irregular black bands.
  a''. Total length from nose to tail-tip over 5 feet in adults.................. *F. nebulosa*, p. 72.
  b''. Total length under 5 feet.......... *F. marmorata*, p. 74.
c. Uniformly coloured or with more or less indistinct transverse bands; size moderate or small.
  a'. Chestnut (rarely dark brown) above; tail whitish below .... *F. temmincki*, p. 75.
  b'. Silvery grey or buff; fur long, thick, and soft......................... *F. manul*, p. 83.
  c'. Tawny or grey.
    a''. Tail less than one third of total length .... *F. chaus*, p. 86.
    b''. Tail about one third of total length; transverse bands much more distinct *F. torquata*, p. 85.
B. Ears long, pointed, with a pencil of hair exceeding half an inch in length at the end.
  a. Tail about one fourth of total length .... *F. caracal*, p. 88.
  b. Tail less than one fifth of total length.... *F. lynx*, p. 89.

28. Felis leo. *The Lion.*

Felis leo, *L. Syst. Nat.* i, p. 60 (1766); *Blyth, Cat.* p. 53; *id. P. Z. S.* 1863, p. 182; *Jerdon, Mam.* p. 91; *D. G. Elliot, Mon. Felidæ*, pl. i.

Sher, *Babar-sher*, *Singh*, Hindi; *Untia-bágh* (Camel-tiger), Guzerati; *Sáwach*, Kattywar; *Shingal*, Bengali; *Süh* or *Suh* ♂, *Siming* ♀, Kashmiri; *Rastar*, Brahui.

Pupil round. A heavy mane of long hair (varying in length however) all round the neck and on the sides and crown of the head in adult males only. Tail about half the length of the head and body, well tufted at the end, a small horny point at the tip, surrounded by the tuft. Caudal vertebræ 24 or 25.

The skull of a lion is thick, heavy, and massive, with a broad zygomatic arch and well-marked sagittal and occipital crests. The superior surface is remarkable for its flatness; the postorbital processes, too, are very nearly in the same plane as the forehead. The posterior termination of the maxillary bones on the face between the orbits is opposite the end of the nasals. The exposed portion of the presphenoid bone in the mesopterygoid fossa is very narrow, and usually flat. The lower edge of the mandible is convex, owing to a small projection below the hindmost lowest molar. In all these characters the skull of a tiger differs.

Colour. Tawny (pale yellowish brown) everywhere, except the black tail-tuft and the outside of the ears, which are black towards the base, but not at the tip; the hairs of the mane in the prime of life are also more or less black-tipped. Young cubs are marked with darker spots or irregular bands, and faint spots may often be seen on the belly and sides of almost adult or even adult animals, especially females.

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Dimensions. Head and body 5½ to 6½ feet long, tail 2½ to 3. A male measured: head and body 5 feet 11 inches, tail 2 feet 11 inches; a female 5 feet 5 inches and 2 feet 7 inches. A lion measuring 8 feet 9½ inches was 3 feet 6 inches high. The female is considerably smaller than the male, and, as with tigers, some individuals probably are larger, others smaller than the above extremes. The hairs of the mane are 10 inches to a foot long in some Indian lions. A skull of an adult male lion measures in extreme length 13 inches, breadth across zygomatic arches 9·4.

Distribution. In India the lion is verging on extinction. There are probably a very few still living in the wild tract known as the Gir in Kattywar, and a few more in the wildest parts of Rájputána, especially Southern Jodhpur, in Oodeypur, and around Mount Abú. About 20 years ago lions were common near Mount Abú, several were shot near Gwalior, Goona, and Kota, and a few still existed near Lalitpur, between Saugor and Jhansi. One is said to have been killed near Goona in 1873. In 1864 one was killed near Sheorajpur, 25 miles west of Allahabad; and when the railway was being made from Allahabad to Jubbulpoor, in 1866, a fine lion, with a good mane, was shot by two of the engineers near the 80th milestone from Allahabad. About 1830 lions were common near Ahmedabad. Several years previously, in the early part of the century, lions were found in Hurriana to the northward, and in Khandesh to the south, in many places in Rájputána (one was shot in 1810 within 40 miles of Kot Deji, in Sind), and eastward as far as Rewah and Palamow. It is probable that this animal was formerly generally distributed in North-western and Central India*. I have never heard of lions in Cutch, and suspect Jerdon was mistaken in supposing them to be found there.

Eastward and north of India the lion is not found, and almost the only part of Western Asia in which it is common is in Mesopotamia and part of South-western Persia. As is well known, this animal abounds throughout Africa.

Varieties. For a long time it was supposed that the Indian lion was maneless, and in numerous books on natural history there are accounts of the "Maneless lion of Guzerat" (*F. leo guzrattensis*, Smee, Trans. Z. S. i, p. 165, pl. xxiv; P. Z. S. 1833, p. 140). It is probable that maneless male individuals may occasionally occur, and it is well known that lions in some parts of Africa, *e.g.* the Cape and Algeria, have longer manes than in other tracts. It is also asserted that lions inhabiting forests have shorter manes, owing to the hairs being pulled out by thorny bushes, but this is doubtful. It is certain, however, that some adult Indian lions have well-developed manes, and the typical maneless Guzerat lion in the British Museum is immature. The lion figured by Captain Smee was shot near Ahmedabad, and was a short-maned lion, similar to most Persian or Abyssinian animals.

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* J. A. S. B. xxxvi, pt. 2, p. 189; P. A. S. B. 1868, p. 198; Journ. Geog. Soc. 1870, p. 204.

Habits. The habits of tigers and lions are for the most part similar, except that the tiger inhabits more wooded countries. Both animals are mainly nocturnal in their movements, sleeping in the daytime and wandering greatly in search of food at night. Both are excessively powerful, and able to kill large animals, such as full-grown cattle, horses, or even camels for food, and both occasionally kill men, and are greatly feared by the inhabitants of the country. Round animals of so ferocious a nature a series of myths have naturally collected, and it is difficult to unravel the true from the false in such traditions. It is not surprising that even intelligent sportsmen, finding that particular classes of natives have a singularly accurate knowledge of the haunts and habits of wild animals, should not always be able clearly to distinguish which of these habits have actually been observed, and which are merely traditional, both being equally believed in by the narrators.

Lions are perhaps bolder than tigers, and certainly much more noisy, their habit of roaring, especially in the evening and at night, having necessarily attracted the attention of all who have been in countries infested by them. Of the two the tiger, though standing lower, is heavier in the body, and I think the more powerful animal.

In India lions feed chiefly on deer, antelopes, wild pigs, cattle, horses, donkeys, and camels, and used formerly to kill many of the latter. Whether lions usually kill their prey, as tigers do, by breaking the neck, I cannot say; in the only cow I ever saw that had been killed by a lion (in Northern Abyssinia) the vertebræ were not dislocated. I also saw a lioness hold a camel by the throat for some minutes, without attempting to break its neck.

Lions are more easily tamed than most of the felines. They often breed in confinement*. The period of gestation is about 108 days, and from three to six young (in India it is said two to three) are commonly born in one litter. The eyes are open at birth. Young lions want the mane, which becomes gradually developed after the full growth is attained.

29. **Felis tigris.** *The Tiger.*

Felis tigris, *L. Syst. Nat.* i, p. 61 (1766); *Blyth, Cat.* p. 54; *Jerdon, Mam.* p. 92; *D. G. Elliot, Mon. Fel.* pl. iii.

Bágh, Sher (female *Bághni, Sherni*), H.; *Náhar, Sela-vágh*, H. of Central India; *Babr*, P.; *Mazar*, Baluchi; *Shinh*, Sindhi; *Padar suh*, Kashmiri; *Patayat-bágh, Wahág*, Mahr.; *Go-vágh*, Beng.; *Tut, Sad*, Hill tribes of Rájmehál; *Garúmkúla*, Kol.; *Lákhra*, Uraon; *Krodi*, Kondh; *Kula*, Sonthal, Ho and Korku; *Púli*, Tam., Tel., Mal., and Gond; *Púli-redda-púli, Peram-pilli*, Tam.; *Pedda-púli*, Tel.; *Perain-púli, Kúdua*, Mal.; *Kuli*, Can.; *Nári*, Kurg; *Pirri, Bürsh*, Toda; *Tág*, Tibetan; *Túkt* or *Tük*, Bhot.; *Sathong*, Lepcha; *Keh-va*, Limbú; *Schi*, Aka; *Matsá*, Garo; *Kla*, Khasi; *Sa, Ragdi, Tekhu, Khudi*, Naga; *Humpi*, Kúki; *Sumyo*, Abor.; *Sü*, Khamti; *Sirong*, Singpho; *Kei*, Manipuri; *Misi*, Kachari; *Kya*, Burmese; *Kla*, Talain; *Khi, Botha-o, Tupuli*, Karen; *Htso*, Shan; *Rimau, Harimau*, Malay.

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* For an excellent account of the lions bred in the Dublin Zoological Gardens, see V. Ball, Trans. Roy. Irish Academy, xxviii, p. 723.

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Pupil round[*]. Hair of the cheeks from behind the ears round the sides of the neck considerably lengthened in adult males, so as to form a ruff. Hair of body short and close (but varying in length somewhat with the season). Tail about half the length of the head and body, tapering gradually, not tufted at the end. Tail vertebræ 22 to 26.

The skull is very massive and heavy, the zygomatic arches excessively wide and strong, and the crests for attachment of the muscles highly developed. On an average the skull is even larger, wider, and more massive than that of the lion. The facial surface is considerably more convex, the maxillary bones terminate posteriorly between the orbits in front of the nasals, and the lower surface of the presphenoid in the roof of the posterior nares is much broader than in the lion, and is generally raised into a ridge along the middle. The lower surface of the mandible is nearly straight to near the angle, then slightly concave. Consequently the skull of a tiger, with the lower jaw attached, rests firmly on a flat surface, whilst the posterior portion of the skull nowhere touches the surface. This is not the case with any other great feline, except perhaps the jaguar.

Colour. Ground-colour, above and on the sides, varying from pale rufous to brownish yellow, below white, striped transversely with black throughout the head and body. The tail is marked with black rings. Ears black outside, with a large white spot on each. The ground-colour is much more rufous in some animals than in others, and forest tigers are probably darker and redder than those inhabiting the thin jungles of Central and Southern India. Young animals, too, are more brightly coloured than old. The young are born striped. Both black and albino tigers have been met with, though both are very rare. Mr. C. T. Buckland tells me that he once saw a black tiger that had been shot near Chittagong; whilst an albino tiger was exhibited in London, at Exeter Change, early in the century, and figured by Griffith[†].

Dimensions. Adult males measure 5½ to 6½ feet from nose to insertion of tail, the tail being about 3 feet long. In a male 9 feet 4 inches long, measured by Tickell, the head was 16 inches, neck 12, body 4 feet, tail 3 feet 2 inches. Females measure about 5 to 5½ feet from nose to rump. The height at the shoulder is about 3 feet to 3 feet 6 inches. The usual measurement of tigers by sportsmen is from the nose over the curves of the head and back and along the tail to the tip. Thus measured full-grown tigers are generally 9 to 10 feet long, tigresses 8 to 9; but tigers have been killed 12 feet in length, and I myself shot an apparently full-grown tigress only 7 feet 6 inches long, and another specimen that had cubs with her measured only 7 feet 8 inches[‡]. The skull

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[*] Jerdon is in error in stating that the pupil is vertical.

[†] Griffith's 'Cuvier,' ii, p. 444.

[‡] A very good account of the measurements of tigers is given in Sterndale's 'Mammalia of India,' pp. 162, 527. See also Sir J. Fayrer, 'Nature,' June 27th, 1878, xviii, p. 219. By both tigers measuring over 12 feet are recorded. Tickell, in his MS. notes, states that he once saw a tiger that measured 11 feet 9 inches.

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of a male tiger 9 feet 7 inches long measured 13 inches in extreme length, 12 in basal length, and 9 in breadth across the zygomatic arches; that of a large Nepal tigress 10 inches in extreme length by 7·8 in zygomatic breadth. But an enormous skull from Purneah measures according to Sterndale 15·25 by 10·5. Sanderson found a bulky, well-fed male tiger to weigh 25 stone (350 lbs.), and Elliot gives the weight of two large male tigers as 360 and 380 lbs., and of a large tigress 240 lbs. Forsyth gives much higher weights, but it is not clear whether he actually weighed the animals.

Distribution. Throughout India, Burma, and other parts of South-eastern Asia, Java, and Sumatra, but not Ceylon, nor, it is said, Borneo. The tiger occurs in suitable localities throughout a great part of Central Asia, and is found in the Valley of the Amur, the Altai Mountains, around Lob Nor in Eastern Turkestan, about the Sea of Aral, on the Murgháb near Herat, on the southern coast of the Caspian (Hyrcania), and in the Caucasus, but not in Tibet, Afghanistan, Baluchistan, or Persia south of the Elburz Mountains on the Caspian.

In India tigers still occur wherever large tracts of forest or grass-jungle exist; but within the last 20 or 30 years the number of these destructive animals has been greatly reduced, and they have now become scarce, or have even in some cases disappeared entirely in parts of the country where they formerly were common. This has been the case especially throughout a large area of the Central Provinces, in many parts of Bengal, and several districts of the Bombay Presidency. In the forests at the base of the Himalayas tigers are common, and they ascend the hills occasionally to an elevation of 6000 or 7000 feet, but none are found in the interior of the mountains. The species is entirely wanting throughout Baluchistan, Afghanistan, and the other countries due west of India, and is only found in a few places in Upper Sind and the western Punjab. It is wanting in Lower Sind and Cutch. To the eastward, in Assam and Burma, tigers are generally distributed.

The absence of tigers in Ceylon would seem to indicate that this animal has only recently migrated into Southern India, more recently than most of the other mammals, the majority of which are found on both sides of Palk Straits.

Habits. For a full account of the habits of tigers, on which more has been written than probably on any other wild animal, reference may be made to numerous works by Indian sportsmen. Foremost amongst these are Sir J. Fayrer's 'The Royal Tiger of Bengal,' Sterndale's 'Seonee' and 'Natural History of Indian Mammalia,' Forsyth's admirable 'Highlands of Central India,' Sanderson's equally accurate 'Thirteen Years among the Wild Beasts of India,' and McMaster's 'Notes on Jerdon's Mammals of India.' The first gives an account of the tiger in the grass-jungles and swamps of the Ganges valley, the second and third describe the animal haunting the forests of the Central Provinces, the fourth writer's experience was mainly gained in Mysore, and that of the fifth in the hills of Southern India.

GSL

Tigers are monogamous. The period of gestation is about 14 to 15 weeks, and from 2 to 5 young, and occasionally it is said even 6, are produced at one time. I have on more than one occasion known four cubs to be cut out from a tigress's body after death. There is no particular season for breeding. Young cubs are found at all times of the year. The tigress is said to avoid the male when about to bring forth, and to hide her young from him; but tigers are occasionally, though not often, seen accompanying tigresses and cubs. The young remain with the mother until nearly or quite full-grown; and when more than two tigers are found consorting together, the party consists in general of a tigress and her full-grown offspring, the old tiger occasionally associating with his family also. Forsyth observes that a tigress cannot have young more frequently than once in three years, because the cubs take about that time to attain their full growth.

These animals are usually found solitary or in pairs, less frequently in parties of from three to six. They remain at rest during the day, and roam about at night in search of food. Their wanderings are considerable, and frequently extend to many miles in the course of the night, a preference being given to well-beaten tracks or sandy beds of streams. On these, in the early morning, every incident of the night's adventures may be traced by an experienced tracker. The tiger sometimes continues his stroll in the early morning, and his movements, as Forsyth remarks, "may often be traced up to eight or nine o'clock by the voices of monkeys and peafowl, the chatter of crows and small birds, and the bark of sámbar and spotted deer." The alarm-cries of all these animals are quite peculiar and different from their ordinary calls; but it must be remembered that the cause of their alarm may be a leopard, a wild cat, a bear, a dog, or even in some cases a man, and not necessarily a tiger.

The tiger usually takes up his abode for the day in deep shade, especially in the hot season, and in general near water under a dense bush or tree, in high green grass, or in thick low cover such as green rushes, tamarisk, or some of the other plants that grow in the beds of streams. Not unfrequently a high bank affords him the cool shade he loves, and in rocky parts of the country caves are frequently resorted to; where ruins exist in jungle they are often a favourite abode. A well-known habit of all wild animals, but especially remarked in the case of the tiger, is the regularity with which particular haunts are selected in preference to others that appear equally well suited. Some one patch of high nul grass near the river-bank or on the edge of the swamp, one dense thicket of *jhow* (*Tamarix*) or *jáman* (*Eugenia*) amongst a dozen apparently similar in a stream-bed, one especial pile of rocks amongst hundreds along the hill-side, will be the resort year after year of a tiger, and when the occupant is shot, another, after a brief interval, takes his place.

Tigers, especially in the cold and wet seasons, when there is abundance of cover and water, are great wanderers, roaming from

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place to place, though probably keeping in general within an area of 15 or 20 miles in diameter. In the hot season from March to June their range is usually more restricted, as vegetation is dried up or burnt except near the few spots where water is still found.

As has already been remarked, tigers are very much less in the habit of roaring than lions are. Where the latter are common scarcely an evening passes without their being repeatedly heard. I have often been in places where tigers were equally abundant, but it is an exception for their roaring to attract attention *. Their usual call is very similar to that of the lion, a prolonged moaning, thrilling sound, repeated twice or thrice, becoming louder and quicker, and ending with three or four repetitions of the last portion of it. Besides this, there is a peculiar loud "woof" produced when the animal is disturbed or surprised, a growl that it utters when provoked, and the well-known guttural sound of rage repeated two or three times when it charges. When hit by a bullet a tiger generally roars, but tigresses, at all events, very often do not; I have on three occasions at least known a tigress receive a mortal wound and pass on without making a sound.

Tigers swim well and take readily to water, even crossing arms of the sea. They but rarely ascend trees, and appear quite incapable of climbing a vertical stem, large or small. It is true that they have been known to take men out of trees, from heights it is said of even 18 or 20 feet; but such cases are always due to some peculiarity in the tree, a sloping trunk, or a fork 8 or 10 feet from the ground, from which the animal can get a fresh start. As a rule a tiger, like other mammals, pays no attention to men in a tree even a very few feet from the ground, if they do not move or speak.

In fact tigers are much less addicted to springing than is popularly supposed, and rarely move their hind legs off the ground except to clear an obstacle. Still they are capable of springing some distance. They have a habit, like cats, of scratching wood, and often show a predilection for the trunk of a particular tree, on which the marks of their claws may be seen up to a height of 10 or, it is said, 12 feet.

The ordinary game-eating tiger of the forest lives mainly on deer and pigs, and avoids the neighbourhood of human habitations. Almost all tigers, however, occasionally kill cattle. The wild animals commonly eaten by tigers are pigs, deer of all kinds, nylgai, four-horned antelope, and porcupines. The last are evidently a common prey. I have repeatedly, in the Central Provinces, when skinning tigers, found fragments of porcupine-quill encysted beneath the skin. Peafowl may be slain at times, but more often, I think, by leopards than by tigers, and the same may be said of monkeys. Bears, though not often attacked, occasionally fall

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* It is true that my own experience was at not quite the same time of the year. I have been repeatedly in jungles inhabited by tigers from November till June, and only in lion-haunted tracts in July and August. But all travellers notice the noisiness of lions.

GSL

victims. I have more than once seen unmistakable remains of a bear that had been devoured; and Sanderson relates an instance of a tiger that was said to have taken habitually to the slaughter of bears for food. Young gaur are occasionally killed, but the full-grown animal is more than a match for most tigers. Instances are said to have been known of even young elephants being attacked, one such is mentioned by McMaster. In fact a hungry tiger will probably kill any other animal he can for food. He is said to have been observed catching and eating frogs; and Mr. Simson found tigers in Eastern Bengal, during inundations, feeding upon fish, tortoises, crocodiles, and large lizards, and he once killed a tiger the pouch of which was crammed with grasshoppers or locusts. It is not to be supposed that the tiger's prey is killed without a struggle, and the more powerful animals sometimes beat off their assailants, whilst instances have been recorded in which large boars have killed tigers that attacked them, the two having in some cases been found dead together.

Great numbers of domestic animals are killed by tigers annually, and many of the latter appear to live entirely upon cattle. Oxen are the ordinary prey of the cattle-eating tiger, who is often an older animal than the game-killer, having become by long experience more cunning and less afraid of man. Tigresses with cubs also often quarter themselves upon a village and subsist in luxury on the flocks and herds of the villagers. Sheep and goats are not so often attacked, tigers having a distinct preference for beef, but ponies, and even horses and camels, are occasionally killed. Buffaloes in a herd are fully able to defend themselves, and generally attack a tiger, many incidents being recorded in which they have rescued their herdsman; but tigers often kill young buffaloes if they are found away from the herd.

There has been much discussion as to the manner in which the tiger kills its prey. The popular notion was, and probably still is, that the tiger springs upon its victim from a distance, and either kills the animal by one blow of its paw, or tears the throat with its teeth and sucks the blood. All this is certainly incorrect, so far, at all events, as cattle are concerned; small animals may perhaps be killed by a blow of the paw. I have seen many oxen that had been killed by tigers, and in numerous cases (always, I think, when I ascertained the point) the neck had been broken, whilst in several instances, despite the marks of fangs upon the throat, the great blood-vessels of the neck were untouched, and claw-marks were confined to scratches on the forequarters. All these details agree with the description given by Sanderson from the accounts received from herdsmen. According to these, the tiger does not spring upon his prey: "clutching the bullock's forequarters with his paws, one being generally over the shoulder, he seizes the throat in his jaws from underneath and turns it upwards and over, sometimes springing to the far side in doing so, to throw the bullock over and give the wrench which dislocates its neck. This is frequently done so quickly that the tiger, if timid, is in retreat again before the herdsman can turn round." It is probable that with smaller animals the tiger does not always take the trouble to break the neck, and in the case of large beasts such as buffaloes and gaur, which he is unable to overthrow, he occasionally hamstrings them, I think by a blow with his claws, but am not sure. I have twice known instances in which buffaloes were left hamstrung by tigers. Tigers sometimes undoubtedly kill or disable by the fearful blows they can give with their paws, but the above is, I believe, their usual plan of killing oxen.

Sterndale confirms Sanderson's account, and also points out that a tiger very rarely springs upon his prey; he probably takes advantage of the momentary paralysis produced by his appearance to make a short rush and to seize the animal he intends to devour. He generally stalks as near as he can, but he has been seen to gallop after animals for some distance before seizing one of them.

I quite agree with Sanderson, who regards "the venerable belief in tigers sucking the blood of their victims" as one of the numerous myths that have collected around beasts of prey in the course of ages.

If an animal is struck down in the daytime, the body may be dragged some distance, but is usually left untouched till evening. At or soon after nightfall, or occasionally in quiet places before sundown, the tiger returns to the kill (known as *ghara* or *mara*), and, if the spot is open or otherwise unsuited for his repast, drags the body to a more convenient place. The enormous muscular power of the tiger is shown by the way in which he can transport large carcases of oxen or buffaloes over rough ground, up and down steep banks and through thick bushes. He sometimes lifts the body completely off the ground; Sanderson mentions an instance in which a bullock, weighing about 400 lbs., was thus carried for 300 yards. He almost always commences by eating the intestines and hindquarters. As a rule he remains near the kill, sometimes rushing out upon any intruder and driving away jackals, vultures, and other carrion-feeders; but more often he hides the carcase under bushes or leaves, and retires to a neighbouring thicket beside water. If very hungry, a tiger will devour both hindquarters the first night. If undisturbed, he generally remains about three days near the carcase, feeding at intervals. In one case, so far as I could learn, a large ox was completely devoured in 48 hours, only a few fragments of bones and the contents of the stomach being left. Forsyth says that a tiger which lives entirely on cattle kills an ox about once in five days, and passes about two days after finishing his last victim without looking about for food, though he will strike down another quarry if it comes near him. Young tigers are more destructive than older animals, and when one gets amongst a herd of cattle, he frequently kills several, apparently in pure wantonness. A tigress with cubs, too, is frequently very destructive, partly, it is said, in order to teach the young tigers to kill their own prey. An animal that has been fired at, especially if he has been wounded, when returning to the kill, will frequently never again return to the body of his prey, but kill afresh when hungry.

GSL

It is well known that, although tigers as a rule kill their own food, they do not disdain carrion; in numerous instances they have been known to eat animals killed by sportsmen and even bullocks that had died of disease. Cases are even on record in which a tiger that had been shot has been devoured by another of his own species.

The ordinary game- or cattle-eating tiger is the greatest of cowards in the presence of man, and often allows himself to be pelted off from the animal he has seized. Sterndale mentions a case in which a herdsman laid his heavy iron-bound staff with impunity across the back of a tiger who had seized one of his cows; and I once found two young children, the eldest not more than 8 or 9 years old, left in jungle to drive a tiger away from the body of a bullock he had killed, and to prevent his eating it or dragging it away. The half-wild inhabitants of the Indian forests have but little fear of ordinary tigers; and after some 20 years' wanderings in large part through tracts infested with tigers, I agree with Forsyth that, except in the haunts of a man-eater, there is little danger in traversing any part of the jungles. Bears are, I think, more to be feared than tigers. The only tigers not being man-eaters that are dangerous are tigresses with young cubs, and occasionally a hungry tiger who has just killed his prey. Of course this only refers to unwounded tigers; a tiger that has been wounded will usually attack any one who approaches him, but even he will not charge home against a body of men, and one successful method of shooting tigers and following them when wounded is founded on this circumstance.

The man-eater is, to quote Forsyth, "a tiger who has got very fat and heavy, or very old, or who has been disabled by a wound, or a tigress who has had to bring up young cubs where other game is scarce. All these take naturally to man, who is the easiest animal of all to kill, as soon as failure with other prey brings on the pangs of hunger." A tiger that has once taken to man-eating will probably, having got over his innate fear of the human species, continue to live upon the same prey, though it is the exception for even man-eaters to confine themselves to human food. Still a few do so to a great extent, and a fearful scourge such a tiger becomes. The destruction of human life by tigers is still considerable in India, and the whole takes place in comparatively thinly peopled portions of the country. Thus in Lower Bengal alone in six years 1860–66, 4218 persons were killed by these animals. In all probability nearly the whole destruction was caused by a very small percentage of the tigers inhabiting the country.

Forsyth says that great grazing districts, into which cattle come for a limited season only, are always the worst for producing man-eating tigers. There is much reason for believing that a tigress, who has taken to preying upon man, brings up her cubs to the same mode of life. A man-eater generally becomes cunning and suspicious beyond all ordinary tigers, and around this, the most terrible of all wild animals, myths and legends centre until it is difficult to know what is true and what is false. Many of the wolf-legends of Europe may be found repeated and intensified in connection with the Indian tiger. Foremost among these tales is of course the wehr-wolf superstition—a belief that certain men have the magical power to transmute themselves at will into wild beasts. But the most remarkable of all is the creed, universal in the Central Provinces and generally prevalent, I believe, throughout India, that the spirits of those men who have been killed by a tiger attend him and sit upon his head, and that they not only warn him against danger, but, entertaining malice against their fellow-men, aid him to destroy them. This superstition exists amongst many races.

Tigers or representations of tigers are actual objects of adoration, or, to speak more correctly, propitiation, amongst some of the wilder tribes of the Indian Peninsula; and one form of oath in Courts of Justice is, or was formerly, administered on a tiger's skin. Various parts of the animal, such as the front teeth, the claws, the whiskers, and the rudimentary clavicles (*birnukh*), are preserved as amulets and charms. The whiskers, Jerdon says, in some parts of Southern India are considered to endow the fortunate possessor with unlimited power over the opposite sex. In other parts they are regarded as a deadly poison, and are destroyed as soon as a tiger is killed.

To one peculiar and wide-spread myth, the relations between tigers or lions and jackals, some reference will be found under the head of the latter.

The destruction of so dangerous an animal as the tiger is naturally one of the principal objects both of the native shikári, who kills for the reward given by Government, and varying from Rs. 5 to Rs. 50 in different districts, and of the European sportsman. The common native plan, adopted occasionally by Europeans, is to build a platform, or *machán*, in a tree, either close to the carcase of an animal that has been killed by a tiger, or to a spot where a live animal, usually a bullock or young buffalo, is tied up as a bait, and to shoot the tiger when he comes to feed on the carcase or to seize the bullock. Another system, adopted by Europeans from Indian chiefs, is to drive the jungles with a line of elephants, the sportsmen shooting from howdahs. This is often almost the only practicable plan in the great plains of Bengal and Upper India, which are covered with grass from 8 to 20 feet high.

In the smaller jungle-patches of Central and Southern India, tiger-shooting is chiefly attempted in the hot season, and the tiger is either driven by beaters past a tree on which the sportsman sits, or followed up, either on an elephant or on foot. Baits, usually young buffaloes, are tied out in selected spots, in order to induce the tiger to kill, and remain during the heat of the day in places convenient for finding him; and native trackers, many of whom could probably vie with the far-famed American Indians themselves, are employed to follow up the animal and ascertain where it is lying. A full account of this method is given by Forsyth in the 'Highlands of Central India.' Occasionally, especially when a tiger has been wounded, a herd of buffaloes are employed to drive him out of the cover, which they do very effectually, charging him in a body if he does not retreat.

In some parts of Southern India a plan is adopted of enclosing a small area of jungle, into which a tiger has been traced, by nets. The animal is then speared or shot when occasion offers. A full account of this method is given by Sanderson in the work already quoted. According to Jerdon, in the Wynaad tigers are driven into a net and speared by a particular class of natives.

It would be impossible to notice all the methods adopted for destroying tigers. In some parts of the country traps are used, but the cage-trap, though often successful in capturing panthers, is seldom so with tigers. Tigers are occasionally taken in pitfalls. A kind of figure-of-4 trap with a heavy platform loaded with stones, that falls upon the tiger and crushes him, is used in parts of Orissa and, I believe, elsewhere. In Burma a bow is set with a poisoned dart, and let off by a string across the path. Spring-guns have also been used. Poisoning the carcase of an animal killed by a tiger is also resorted to in some cases, strychnine being chiefly used for the purpose by Europeans, but it is not always effective.

The age to which tigers live is not clearly ascertained. Sanderson mentions an instance in which he killed a large cattle-eating tiger that had been known to haunt a particular group of villages for twenty years. This animal showed no signs of age except that his coat was becoming light-coloured.

Tigers captured young are easily tamed, and many of the adult animals in menageries are perfectly good-tempered, and fond of being noticed and caressed by those whom they know. They have repeatedly bred in confinement, though not so freely as lions, and the cubs more rarely survive.

30. **Felis pardus.** *The Leopard or Panther.*

Felis pardus, *L. Syst. Nat.* i, p. 61 (1766); *Blyth, Cat.* p. 55; *Jerdon, Mam.* p. 97; *Elliot, Mon. Fel.* pls. vi, vii.
Felis leopardus, *Schreb. Säugeth.* iii, p. 387, pl. ci; *Kelaart, Prod.* p. 45.

Tendwa, Chita, Sona-chita, Chita-bágh, Adnára, H.; *Palang*, Pers.; *Diko*, Baluch.; *Súh*, Kashmiri; *Tidua, Srighas*, Bundelkand; *Gorbacha* or *Borbacha*, Deccan; *Karda, Asnea, Singhal, Bibia-bágh*, Mahr.; *Tenduwa, Bibla*, Bauris of Deccan; *Honiga, Kerkal*, Canarese; *Teon-Kula*, Kol.; *Jerkos*, Paharia of Rájmehál; *Burkál, Gordág*, Gond.; *Sonora*, Korku; *Chiru-thai*, Tam.; *Chinna-puli*, Tel.; *Puli*, Mal.; *Kutiya*, Cingalese; *Bai-hira, Tahir-hé, Goral-hé*, or *Ghor-hé*, hill-tribes near Simla (according to Jerdon, generally known as *Lakhar-bagha*, a name elsewhere used for the hyæna); *Sik*, Tibetan; *Syik* or *Syiak*, or *Sejjiak*, Lepcha; *Kajengla*, Manipuri; *Misi patrai, Kam-kei*, Kuki; *Hurrea kon, Morrh, Rusa, Tekhu Khuia, Kekhi*, Naga; *Kya-lak* or *Kya-thit*, Burmese; *Klapreung*, Talain; *Kiché-phong*, Karen; *Rimau-bintang*, Malay.

Pupil circular. Tail varying from rather more than half to about three quarters the length of the head and body. Caudal vertebræ usually 24 or 25, but varying, it is said, from 22 to 28.

GSL

The upper surface of the skull is arched, as in the tiger, but the lower jaw is convex beneath, as in the lion, the condyle being proportionally nearer the angle even than in the latter. When a leopard's skull, with the mandible attached, is placed on a flat surface, the hinder part of the skull almost always touches that surface.

Ground-colour above from rufous to yellowish white or pale brownish yellow, sometimes darker, sometimes paler; below white. The whole animal is spotted. The spots or rosettes on the back, sides, and dorsal portion of the tail are black externally, pale-coloured within; they vary much in number, size, and form; the surrounding black border of each spot is more or less interrupted, an unbroken ring being of rare occurrence, whilst the inner pale area is sometimes darker than the ground-colour outside, but usually the same. The spots on the head, distal portions of the limbs, and lower parts have no pale centres. Young leopards are of a brownish colour, and the spots are much less clearly defined.

Dimensions very variable, the total length of head, body, and tail together ranging from 5 to 8 feet. A large male measured:—Head and body 4 feet 9 inches, tail 3 feet 2 inches; total 7 feet 11 inches (*Jerdon*). A smaller animal 3 feet 10 inches and 2 feet 10 inches; total 6 feet 8 inches (*Tickell*). Height at shoulder about 2 feet. An average-sized skull measures 6·9 inches in basal length and 5 inches wide across the zygomata; but in the series of adult skulls in the British Museum the basal length varies from 5·6 inches to 8·1.

Distribution. Asia generally, with the exception of Siberia and the high Tibetan plateau. Found also throughout Africa. In India, Burma, and Ceylon this animal is generally distributed, except in parts of Sind and the Punjab. Fossil remains have been found in Great Britain, Spain, France, and Germany.

Varieties. By very many writers, and amongst Indian naturalists by Sykes, Elliot, Horsfield, Hodgson, and Sterndale, it has been thought that there are two species of Indian leopards—a larger and a smaller. Even Jerdon appears to have been in doubt on the subject. Most of the sportsmen who have hunted in Central India and many native shikáris distinguish these two forms, and in parts of the country there is some appearance of two races—a larger form that inhabits the hills and forests, and a smaller form, commonly occurring in patches of grass and bushes amongst cultivated fields and gardens. The larger form is said to have a shorter tail, a longer head with an occipital crest, and clearly defined spots on a paler ground-colour. The smaller form has a comparatively longer tail, a rounder head, less clearly defined spots, and rougher fur. I cannot help suspecting that the difference is very often due to age *, as in the case of the supposed two species of four-horned antelope, for younger leopards have rounder heads, without

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* Tickell, I find, in his MS. notes makes the same suggestion.

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any occipital ridge to the skull, and rougher fur than older animals. I have for years endeavoured to distinguish the two forms, but without success. The size of the animal, the number, form, and closeness of the spots, and length of tail are all extremely variable characters. The animals found in the damp forests of the Himalayas, Bengal, Assam, and Burma are darker and redder in colour, and have the spots larger in proportion to the interspaces, than the paler-coloured leopards of the Indian Peninsula; and I think some of the leopards of Central India are larger than is usual elsewhere. I cannot myself, as I have said, in many cases determine to which of the two supposed forms an Indian leopard-skin should be referred, yet I can tell most African skins * at a glance, as the spots are very much smaller; and there is a race inhabiting Persia, and found in Baluchistan and the mountains of Sind †, that differs widely from all the others and is quite intermediate in coloration and spotting between the leopard and the ounce, the resemblance to the latter being increased by the long fur and thick hairy tail. These two varieties, the African and the Persian, however, pass by insensible gradations into the ordinary form; and I cannot find any difference in the skulls or evidence to satisfy me that there is any constant distinction between different races of leopards, pards, or panthers. This is the conclusion at which Mr. Blyth also arrived.

A black variety of the leopard is not uncommon. The spots on this can still be traced if the skin is viewed in certain lights, but the general colour is uniform black, the colour of a black cat. This form, though distinguished by some writers as *Felis melas*, is unquestionably only a variety, the occurrence of black and spotted cubs in the same litter having been repeatedly recorded. Black leopards are more common on the hills of Southern India and in Travancore than in other parts of the peninsula; they are also said to be of frequent occurrence in the Malay Peninsula. A white (albino) leopard is figured in Buchanan Hamilton's drawings.

Habits. The habits of leopards differ materially from those of tigers. The leopard is much more lithe and active even than the tiger, climbing trees readily, and making immense bounds clear off the ground. The leopard is often found in the neighbourhood of villages, hiding during the day amongst the crops or in the bushes about cultivation, and carrying off sheep, goats, and especially dogs, at night. In pursuit of his prey he seems to have but little fear of man; he will enter outhouses, native huts, or even tents. He cares but little for the neighbourhood of water even in the hot weather, his favourite haunts being rocky hills covered with thick scrub, and he is generally found in caves and under piles of rocks.

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* Probably the true *F. leopardus* of Erxleben &c. and *F. pardus* of Temminck.

† Probably *F. tulliana*, Val. See Alston and Danford, P. Z. S. 1880, p. 51. I have a fine skin, for which I am indebted to Mr. H. E. Watson, from the Khirthar range on the western frontier of Sind.

CSL

He can conceal himself in the most wonderful way, his spotted hide blending with the ground, and his lithe loose form being compressible into an inconceivably small space. I quite agree with Forsyth, from whom I have taken several of the above traits, that he is more courageous than the tiger; if brought to bay, the leopard will charge again and again with the utmost ferocity.

Large leopards, or panthers as Jerdon calls them, often kill cattle, ponies, donkeys, and large deer such as sámbar, but the smaller varieties have to content themselves with inferior prey. The leopard, however, is absolutely without prejudice in the matter of food—all beasts, birds, and, I believe, reptiles that are not too large to kill or too small to catch are the same to him; he will strike down an ox or bound upon a sparrow. If he has a predilection, it is probably for dogs and jackals. He is a terrible foe to monkeys, and kills many of the hanúmáns or langúrs who inhabit the rocky hills in which he delights. Leopards, like tigers, sometimes kill their prey by breaking the neck; but I am disposed to believe that they frequently either tear open the throat or hold it in their jaws and strangle their victim. However, I have not had many opportunities of seeing animals killed by them. They carry away the body like tigers, and hide what they do not eat, very often in a tree.

Leopards occasionally take to man-eating and, owing to their boldness, become even a more fearful scourge than tigers. In two parts of India, the Sonthál Pergunnahs south of Bhágalpur, and Seoni in the Central Provinces, at about the same time (1857–60), leopards were singularly destructive to human life, taking men, women, and children by night out of houses, or off the macháns or platforms built in the fields to watch the crops from. One leopard near Seoni, commemorated by Sterndale and Forsyth, is said to have killed 200 human beings in two years before he was shot.

The idea that leopards object to cross water, though supported by an observation of Blyth's that a tame animal showed great aversion to wetting his feet, is erroneous. Like other wild animals, they swim well.

The leopard, as a rule, is a very silent animal, rarely, except when provoked, uttering a sound. When surprised and when charging, he makes noises similar to those made by a tiger; but his call is very different. I have occasionally heard a sound which agrees with the description I have received both in Africa and in India of this animal's cry, and which corresponds to the account of it given by Captain Baldwin in the 'Large Game of Bengal.' It consists of a peculiar harsh noise between a grunt and a cough, repeated quickly three or four times. Forsyth calls it a harsh grating roar.

The period of gestation does not appear to have been accurately recorded, but is said to be about the same as in the tiger and lion, or fifteen weeks. The young are born about February or March in the Peninsula of India, and a litter usually consists of two, three, or four cubs. They probably take about the same time as a tiger, three years, to arrive at full growth. Young leopards are more difficult to tame than tigers or lions; and, even when tamed, are less to be trusted. On the whole, this feline has an exceedingly bad character.

Leopards are killed in large numbers by native shikáris, but, despite the greater prevalence of the species, fewer leopards than tigers are shot by European sportsmen. This is due to the difficulty of finding leopards, owing to the manner in which they conceal themselves and to their independence of water, and also to the extremely difficult aim they afford to a rifle, on account of the swiftness of their movements and their power of hiding themselves. The ordinary Indian plan of shooting them is to tether a kid or calf, or occasionally a dog, near the tree in which the hunter sits, and to make the bait bleat from time to time by pulling a string. A favourite device with native shikáris is to put a fish-hook through the unfortunate bait's ear and attach a string thereto. A light from an earthen pot (garra) is sometimes thrown on the tethered animal, or the ground around is sprinkled with chaff or flour to render the leopard more conspicuous at night.

Owing to his greater boldness, a leopard is much more easily trapped than a tiger, and many are taken alive in a kind of cage baited with a live calf, goat, or dog. The bait is usually placed in a separate partition, so arranged as to open and release the bait by the shutting of the door which entraps the leopard. Fall-traps and spring-bows or guns are also used to kill panthers as well as tigers.

31. **Felis uncia.** *The Ounce or snow Leopard.*

Felis uncia, *Schreber, Säugeth.* iii, p. 586, pl. c (1778); *Blyth, Cat.* p. 58; *Jerdon, Mam.* p. 101; *Elliot, Mon. Fel.* pl. iv.
Felis irbis, *Ehrenberg, Ann. Sc. Nat.* xxi, p. 410 (1830).

Ikar, Zig, Sachak, Sáh, Tibetan (Bhotia); *Bharal he* of hills north of Simla; *Thurwágh*, Kunawar.

Fur long, dense, and rather woolly. Tail thick, scarcely tapering, about three quarters the length of the head and body.

The skull differs greatly from that of a leopard, being much higher and more convex when viewed from the side, with a depression at the posterior termination of the nasal bones, which are broad and short; the postorbital processes, too, are less bent down. The face in front of the orbits is very short.

Colour. Ground-colour above very pale whitish grey, sometimes with a yellowish tinge, below white; the whole animal spotted with black. The spots on the back, sides, and tail are large, black, interrupted rings or rosettes of rather irregular shape, much larger than in leopards, the space inside each ring being usually rather darker than the ground-colour; spots on the head, limbs, and terminal portion of the tail without pale centres; the spots on the belly few in number and rather indistinct. From near the middle of the back to the root of the tail is a median dark band. Ears black, each with a large yellowish spot.

Dimensions. Head and body about 4 feet 4 inches, tail 3 feet, height 2 feet. A skull measures about 6 inches in basal length, and 4·75 in zygomatic breadth.

Distribution. High Central Asia, especially Tibet, extending north to the Altai, and west, it is said, into Persia. This, however, and the reported range still further to the westward into Armenia, is somewhat doubtful; the peculiar pale-coloured variety of leopard found in Western Asia (*F. tulliana*) may have been mistaken for an ounce (see Alston, P. Z. S. 1880, p. 51). The ounce is found throughout the Himalayas at high elevations, and is more abundant on the Tibetan side of the Snowy Range, where it is met with in the Upper Indus and Sutlej valleys. It is fairly common in Gilgit. It is known to sportsmen as the snow leopard.

Habits. Not much is known of the ounce's life-history. It lives amongst rocks at considerable elevations, never, it is said, below 9000 feet above the sea in the Himalayas. This, however, may be in summer; for Scully relates that in Gilgit the ounce descends as low as 6000 feet in winter. It preys upon wild sheep and goats (ibex, markhor, and thár), and probably upon any rodents (marmots, hares, *Lagomys*, &c.) or birds it can capture; it carries off sheep, goats, and dogs from villages, and even kills ponies, but, it is said, has never been known to attack man.

32. **Felis nebulosa.** *The clouded Leopard.*

Felis nebulosa, *Griffith, Carnivora*, p. 37, plate (1821).
Felis diardi, *Cuv. Oss. Foss.* ed. nouv. (2^{e}) iv, p. 437 (1823); *Blyth, P. Z. S.* 1863, p. 183; *Jerdon, Mam.* p. 102; *Elliot, Mon. Fel.* pl. viii.
Felis macrocelis, *Temminck, Horsf. Zool. Journ.* i, p. 543 (1825); *Tickell, J. A. S. B.* xii, p. 814; *Blyth, Mam. Birds Burma*, p. 27.
Felis macroceloides, *Hodgs. Calc. Journ. N. H.* iv, p. 286 (1844) (no description); *id. P. Z. S.* 1853, p. 192, pl. xxxviii; *Blyth, Cat.* p. 58.

Pungmar, *Satchuk*, Lepcha; *Zik*, Limbu; *Kung*, Bhotia; *Lamchitia*, Khas tribe, Nepal; *Thit-Kyoung*, Burmese; *Arimau dahan* (tree tiger), Malay; *Clouded Tiger* of British naturalists.

Size of a small leopard. Pupil oval, vertical. Tail thickly furred, nearly the same thickness throughout, and long, about four fifths the length of the head and body. Caudal vertebræ 25.

Skull long, low, and narrow. Orbit widely open behind. Hinder termination of bony palate concave; mesopterygoid fossa narrow. Lower edge of mandible straight from symphysis to near the angle, then concave. The upper canines are longer relatively than in any other living cat, and have a very sharp edge posteriorly. Anterior upper premolar frequently but not always wanting.

Colour. General tint varying from greyish or earthy brown (cat-grey) to fulvous (light yellowish brown); lower parts and

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inner side of limbs white or pale tawny. Head spotted above; two broad black bands, with narrower bands or elongate spots between them, commence between the ears, run back to the shoulders, and are prolonged, more or less regularly, as bands of large oval or elongate marks along the back. Sides of body usually divided into large subovate, trapezoidal, or irregularly shaped darker patches by narrow pale bands, the patches in places edged with black, especially behind. In old specimens the dark patches are sometimes indistinguishable, but the black edges remain as irregular stripes. The limbs and underparts are marked with large black spots. Tail with numerous dusky rings, often interrupted at the sides, those near the body traversed above by a longitudinal band. Ears black externally, often with a grey spot in the middle. Two black horizontal cheek-stripes, the upper running from the eye; the margin of the upper lip also black laterally in some specimens. There is an irregular black band across the chin and another on the throat. Blyth states that this animal grows more fulvous with age, the greyer skins being those of young animals.

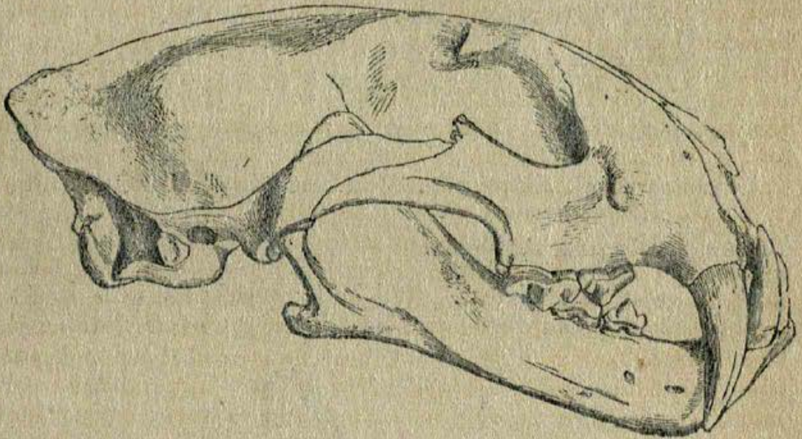
Fig. 17.—Skull of *Felis nebulosa*. (Gray, P. Z. S. 1867, p. 266.)

Dimensions. An old male, measured by Hodgson, was $37\frac{1}{2}$ inches long from snout to vent; tail with hair at end 30, without 29; height $14\frac{1}{2}$, length of ear $2\frac{3}{8}$; weight $44\frac{1}{2}$ lbs. In another specimen the head and body measured $3\frac{1}{2}$ feet, tail 3. A skull larger than usual, from Assam, is 6·2 inches long from the foramen (basal length), and 4·75 broad across the zygomatic arches; another skull 4·7 by 3·6.

Distribution. The clouded leopard occurs in the South-eastern Himalayas, Sikhim, Bhutan, &c., at moderate elevations, probably not above 7000 feet. It is also found in the Assam hills and throughout the hilly parts of Burma, Siam, the Malay Peninsula, Sumatra, Java, and Borneo. A variety with a shorter tail (*Leopardus brachyurus*, Swinhoe) has been obtained in Formosa.

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Habits. Very little is known of the habits of this animal, all that has been recorded hitherto about it in the wild state being derived from the accounts given by native hunters. It is believed to be thoroughly arboreal, living and sleeping in trees, and preying upon birds and mammals. In captivity it appears not difficult to tame.

33. **Felis marmorata.** *The marbled Cat.*

Felis marmorata, *Martin, P. Z. S.* 1836, p. 108; *Blyth, Cat.* p. 59; *id. P. Z. S.* 1863, p. 183; *Jerdon, Mam.* p. 104; *Elliot, Mon. Fel.* pl. ix.

Felis charltoni, *Gray, A. M. N. H.* xviii, p. 211 (1846); *Blyth, Cat.* p. 59.

Leopardus dosul, *Hodgs. Cat. Mam. &c. Nepal, B. M.* 2nd edit. 1863, p. 3 (no description).

Sikmar, Bhotia; *Dosal*, Lepcha.

Larger than a domestic cat. Tail bushy, nearly the same thickness throughout, about three quarters the length of the head and body. Fur soft, thick, with woolly underfur (at all events in Himalayan skins). Ears short, rounded at the end. Bony orbit complete behind in old skulls. The posterior edge of the bony palate deeply concave. Anterior upper premolar apparently often wanting.

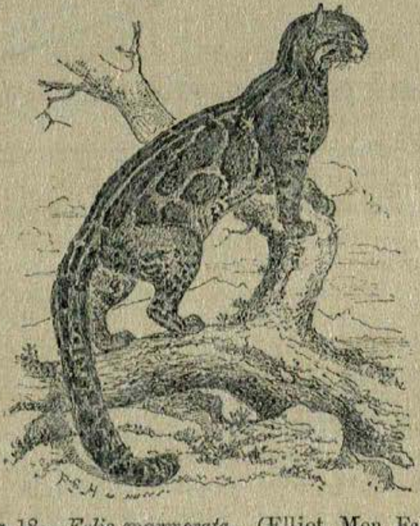

Fig. 18.—*Felis marmorata.* (Elliot, Mon. Fel.)

Colour. Ground-colour varying from brownish grey (earthy brown) to bright yellowish or rufous brown, lower parts paler. The sides divided by narrow pale streaks into large, irregularly shaped darker patches, black on the hinder edges. Along the back are angular black blotches or irregular rings, arranged more or less

GSL

in longitudinal bands. There are black spots on the outside of the limbs, the upper surface of the tail, and usually on the lower parts; but those on the belly are very variable, being sometimes large and distinct, sometimes almost imperceptible. The inside of the limbs and the chest are banded or spotted, and there are the usual cheek-stripes. Two interrupted bands, one from the inner corner of each eye over the head, are continued as well-marked black stripes on the hind neck, spots or bands intervening between them on the head but not on the neck. The underfur is rich brown. According to Blyth, the ground-colour becomes more fulvous with age.

Dimensions. Length of head and body 18½ to 23 inches, tail 14 to 15½, ears from crown of head 2 (*Jerdon*). The basal length of a skull is 2·95 inches, zygomatic breadth 2·6.

Distribution. The marbled cat is found in Sikhim and the Eastern Himalayas, and in the hilly regions of Assam, Burma, and the Malay countries, extending to Sumatra, Java, and, it is said, Borneo. This animal has not been recorded from Nepal.

Habits. Nothing known. *F. marmorata* is probably arboreal, like the similarly coloured *F. nebulosa*. In Sikhim it is said to be shy and fierce.

34. **Felis temmincki.** *The golden Cat.*

Felis temminckii, *Vigors & Horsf. Zool. Journ.* iii, p. 451 (1828); *Elliot, Mon. Fel.* pl. xvi.
Felis moormensis*, *Hodgs. Gleanings in Science*, iii, p. 177 (1831); *id. P. Z. S.* 1832, p. 10; *Elliot, P. Z. S.* 1871, p. 759.
Felis aurata, *Blyth, P. Z. S.* 1863, p. 185; *Jerdon, Mam.* p. 107 *Sclater, P. Z. S.* 1867, p. 816, pl. xxxvi, *nec Temm.*
Felis nigrescens, *Hodgs. Cat. Mam. &c. Nepal, B. M.* 2nd edit. p. 4 (no description).

Size rather less than that of *F. nebulosa*. Pupil very slightly elliptical in a strong light, round in general. Tail about two thirds the length of the head and body, almost the same thickness throughout. Caudal vertebræ 22. Ears short, rounded. Fur of moderate length, dense, rather harsh.

Skull with the orbits nearly complete behind. Lower surface of presphenoid very narrow and bordered by parallel lines.

Colour. Deep ferruginous or chestnut, darker (bay) along the back, paler on the sides, still paler and whitish below; chin and lower surface of tail to the tip white, the tip above is dusky. There are some round dusky spots on the breast, between and behind the axils, and, in some specimens, on the inside of the fore limbs, and less distinct markings, forming imperfect bands, on the throat. The lower side of the tarsi and feet are brown. The markings on the face are peculiar and somewhat variable; the most conspicuous is a horizontal white or buff cheek-stripe, sometimes edged with black, from below the eye to behind the gape; a whitish band

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* The spelling was subsequently corrected to *murmensis* by Hodgson himself in several publications, *e. g.* Calc. Journ. Nat. Hist. iv, p. 286.

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inside each eye; and occasionally curved lines running back from above the eye to between the ears. Ears black or brownish black outside, with an ill-defined pale central spot. Fur brown at the base, ferruginous near the end, some black tips on the back.

A variety of a dark brown colour also occurs (*F. nigrescens*, Hodgson), both in Nepal and Tibet. It has the same white under-surface to the tail.

Dimensions. A fine male, according to Hodgson, who saw the animal alive, measured, length of head and body 31·5 inches, tail 19, height at the shoulder 17, length of ear 2·5. An adult skull from Nepal, in the British Museum, measures 4·8 inches in basal length, and 3·65 in zygomatic width.

Distribution. The South-eastern Himalayas, at a moderate elevation; rare in Nepal, more abundant in Sikhim. Found also in Tenasserim, Sumatra, and Borneo, and probably throughout Burma and the Malay Peninsula. Mason mentions an animal known to the Burmese as the fire-cat or fire-tiger, from its red colour; and Theobald saw a specimen caged at Moulmain. A suggestion has recently been made in the 'Taprobanian,' i, p. 33, that this species may be found in Ceylon, but this is improbable.

Habits. Unknown. Several specimens have been obtained alive; there was one for some time in the Zoological Gardens, London, and another in Calcutta. This cat does not appear easily tamable.

35. **Felis viverrina.** *The fishing Cat.*

Felis viverrina, *Bennett, P. Z. S.* 1833, p. 68; *Blyth, P. Z. S.* 1863, p. 184; *Jerdon, Mam.* p. 113; *Blyth, Mam. Birds Burma*, p. 27; *Elliot, Mon. Fel.* pl. xxii.
Felis viverriceps, *Hodgs. J. A. S. B.* v, p. 233 (1836); *Kelaart, Prod.* p. 46.
Felis himalayanus, *Jardine, Nat. Lib., Felinæ*, p. 230, pl. 24* (1837).
Felis celidogaster, *Blyth, Cat.* p. 61, *nec Temm.*

Banbiral, Báráun, Khupya-bágh, Bágh-dásha, H.; *Mach-bágral*, Beng.; *Hándún-diva*, Cingalese.

Size larger than that of the domestic cat, limbs short and strong; head elongate, ears short and rounded. Fur coarse, without any gloss. Tail about one third the length of the head and body. Caudal vertebræ 19. Pupil circular.

Skull long, occipital and sagittal crests well-developed; muzzle narrow, compressed, elongate; nasal bones long, broad anteriorly, concave on the outer margin. Orbit complete or nearly complete behind in adults. Lower margin of mandible nearly or quite straight. Teeth large.

Colour. Earthy grey, with a more or less marked brownish tinge, darker and browner on the back, paler and whiter below, spotted throughout with black or dark brown. The spots are always much longer than broad, but they vary much in size, sharpness, and definition in different animals; in some they are small and comparatively indistinct, owing to an admixture of grey-tipped hairs;

GSL

in others well-marked and about an inch in length on the sides. From 6 to 8 black lines run from the forehead to the nape, breaking up into shorter lines and spots on the shoulders, but continued as lines of spots down the back. Cheeks greyish white, usually with two well-marked horizontal black or brown cheek-stripes. Several cross bands more or less distinct on the throat and fore neck. Markings on limbs variable; sometimes there are none, but usually there are bars or lines of spots outside the thigh and forearm, and the usual two bars inside the latter. Lower parts spotted. Tail more or less distinctly ringed with black above. Underfur brown, only the longer hairs with a long whitish portion near the end and a black tip; in the spots all the terminal part is black. Feet brown beneath.

Dimensions. Head and body 30 inches, tail 10½ (or with hair 11½), height 15; weight 17 lbs. The above are the measurements and weight of a male, but some specimens are larger. Kelaart gives head and body 34½. A large skull (I have seen even larger) measures 4·85 inches in basal length and 3·5 across the zygomatic arches; another 4·7 by 3·6; a small but quite adult skull 4·2 and 3·05.

Distribution. Bengal, probably Orissa, and the Indo-Gangetic plain generally, extending as far as Sind, whence I have a good specimen procured by Mr. H. E. Watson near Sehwan. Unknown in the peninsula of India, except on the Malabar coast, where it occurs from Mangalore to Cape Comorin, but not, so far as is known, to the northward near Bombay. This species occurs also in Ceylon. Along the base of the Himalayas the fishing cat is met with as far west as Nepal, and ranges throughout Burma, Southern China, and the Malay Peninsula. So far as is known, *F. viverrina* does not appear to be found in the Malayan islands, but it is said to exist in Formosa.

Habits. This species haunts marshy thickets near rivers, swamps, or tidal creeks, and differs from most cats in feeding upon fish. It also, according to Buchanan Hamilton, eats freshwater mollusca such as *Ampullaria* and *Unio*, both of which abound in many of the Indian swamps. Hodgson found that one specimen brought to him had eaten a large snake. The fishing cat, however, like other members of the genus, doubtless kills such mammals and birds as it can. It is said to be very ferocious; both in Bengal and in Malabar it has been known to kill calves, and sheep are not unfrequently destroyed by it. Mr. Baker wrote from Malabar that it often killed pariah dogs, and he had known young infants carried off by it from their parents' huts. A still more remarkable instance of its ferocity is mentioned by Blyth, a newly caught male of this species in his possession having killed a tame young leopardess of twice its own size, after breaking through the partition that separated the cages.

Frequently *F. viverrina* is savage in confinement, but Blyth says he had several males perfectly tame and considered this a particularly tamable species.

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36. **Felis bengalensis.** *The leopard Cat.*

Felis bengalensis, *Kerr, Animal Kingdom*, p. 151 (1792); *Blyth, Cat.* p. 60; *id. P. Z. S.* 1863, p. 184; *Jerdon, Mam.* p. 105; *Anderson, An. Zool. Res.* p. 164; *Elliot, Mon. Fel.* pl. xxi; *Blanford, P. Z. S.* 1887, p. 627.
Felis javanensis, *Desmarest, Nouv. Dict. Hist. Nat.* vi, p. 115 (1816); *Horsf. Zool. Res. Java*, pl.
Felis sumatrana *Horsf. Zool. Res. Java*, pl. (1824).
Felis minuta, *Temm. Mon. Mam.* i, p. 130 (1827).
Felis nipalensis, *Vig. & Horsf. Zool. Journ.* iv, p. 382 (1829).
Felis chinensis, *Gray, Charlesworth's Mag. N. H.* i, p. 577 (1837).
Leopardus ellioti *and* Leopardus horsfieldii, *Gray, A. M. N. H.* x, p. 260 (1842).
Felis pardochrous, *Hodgs. Calc. Journ. N. H.* iv, p. 286 (1844), no description.
Felis ogilbii, *Hodgs. Calc. Journ. N. H.* viii, p. 44.
Felis jerdoni, *Blyth, P. Z. S.* 1863, p. 185; *Jerdon, Mam.* p. 107.
Felis undata, *Blyth, Mam. Birds Burma*, p. 27, *nec Desmarest.*
Felis wagati *and* Felis tenasserimensis, *Gray, P. Z. S.* 1867, p. 400.
Felis herschelii, *Gray, Cat. Carn. &c. Mam. B. M.* p. 28 (1869).
Felis javensis, *Elliot, Mon. Fel.* pl. xxviii (1883).

Chita Billa, H.; *Ban Biral*, Beng.; *Wagati*, Mahr. of Ghats; *Thit-Kyoung*, Arakan; *Kye-thit*, *Thit-kyûk*, *Kya-gyûk*, Burmese; *Kla-hla*, Talain and Karen; *Rimau-ákar*, Malay.

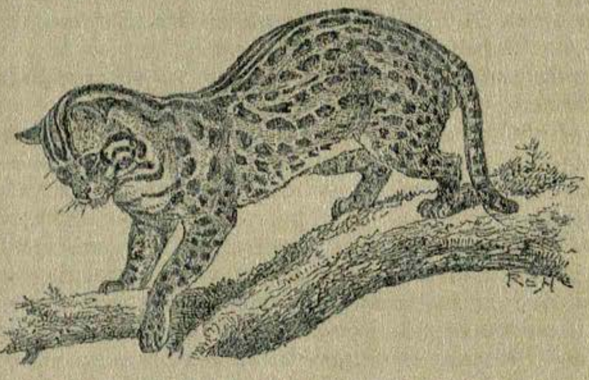

Fig. 19.—*Felis bengalensis*. (Elliot, Mon. Fel.)

About the size of a domestic cat or rather smaller, but with longer legs. Tail rather less than half the length of the head and body together, sometimes perhaps not more than one third, but some measurements give more than one half. Ears moderate, rounded at the tip. Pupil circular (perhaps elliptical in strong light).

The skull is rather elongate, low and convex. Orbit incomplete behind. The inner lobe of the upper flesh-tooth small. Anterior upper premolar rarely deficient.

Colour. Ground-colour above pale fulvous, varying from rufous to greyish, below white, ornamented throughout with numerous more or less elongate, well-defined spots, either black throughout,

GSL

or, especially on the sides, each spot partly black and partly brown, the two colours passing into each other. The fur is brown at the base, and many of the fulvous hairs have white tips, producing a grizzled appearance on the ground-colour. The size of the spots is very variable; they have a general tendency to a linear arrangement, especially on the back. The limbs and underparts are all spotted, the spots on the belly being as a rule, though not always, well defined, and there are spots on the upper surface of the tail, the lower surface of which is generally unspotted, but spots are frequently met with in Himalayan and Burmese varieties. Towards the end of the tail the spots usually become small transverse bars. There is almost always a white band running up to the forehead from the inside of each eye. Four longitudinal black bands commence on the forehead, and are continued over the head to the hind neck, breaking up into short bands and elongate spots on the shoulders; less distinct bands or spots occasionally come in between the two median head-stripes on the forehead and shoulders, but these two stripes frequently coalesce on the back of the neck, diverging again between the shoulders and being continued as rows of spots to the tail. There are generally two well-marked horizontal cheek-stripes, the lower of which is often joined to a transverse stripe across the throat; other transverse stripes, sometimes broken into rows of spots, cross the lower neck and breast. There are the usual two dark bands inside the forearm, and a large whitish spot on the black outside surface of each ear.

In kittens the general colour is pale brown, and the markings are ill-defined.

The coloration of this species is so variable that it is difficult to give a description that is applicable to all the varieties.

Dimensions. Head and body 24 to 26 inches, tail 11 to 12 or more (*Jerdon*). Some varieties are considerably smaller; a Burmese specimen measured by Tickell had the above two measurements only 16 and 9·5 inches. A large Nepalese skull is 3·1 inches in basal length from the foramen to the premaxillaries, and 2·5 wide across the zygomatic arches; whilst in the small Burmese variety (*F. wagati* of Gray) the length and breadth of a skull similarly measured are only 2·7 and 2·1 inches.

Distribution. The leopard cat is common in the Himalayas as far west as Simla, in Lower Bengal, Assam, the Burmese and Malayan countries, Southern China, Sumatra, Java, Borneo, and the Philippines. It is also found in the Syhádri Range or Western Gháts of India, Coorg, Wynaad, Travancore, &c., and in some, perhaps all, of the other forest-regions of the peninsula, though not very abundantly. I have never seen a specimen during several years' wanderings in the Central Provinces and the northern part of the Bombay Presidency. There is, however, a skin said to be from the neighbourhood of the Coromandel coast in the Calcutta Museum; and a living specimen from Jeypore, west of Vizagapatam, was quite recently given to the Zoological Gardens in London by Mr. G. T. Egan. According to Jerdon *F. bengalensis* is also found in Ceylon, but this I doubt; its occurrence is not mentioned by Kelaart, Blyth, or Tennant, nor is there a specimen from the island in the British Museum, which is well supplied with Cingalese Mammalia.

Varieties. In this species the tendency to variation in markings appears to reach its maximum so far as Asiatic cats are concerned, though the American ocelot is at least equally variable. The variation is shown by the number of synonyms this animal has received, and by the great difference in the number of the species into which it has been divided by different naturalists.

After examining the fine series of skins and skulls in the British Museum I have come to the same conclusion as Blyth and Jerdon, and class all the various races as varieties of a single species. As in many other cats, there is a grey phase, to which belong *F. nipalensis*, *F. jerdoni*, *F. javanensis*, *F. chinensis*, and a rufous phase. According to Blyth (Cat. Mam. A. S. p. 60, and P. Z. S. 1863, p. 184, note), some of the grey forms, and especially *F. nipalensis*, are hybrids with domestic cats. There is considerable variation, too, both in size and in the length of the tail.

The following are the principal named varieties:—

The ordinary Himalayan type, *F. pardichroa* of Hodgson, has pale rufescent back and sides, with spots usually subangular or angular in form, each spot black behind and brown in front. In some specimens the spots are large and almost triangular with the points directed backwards, in others the spots are simply elongate ovals and of small size. *F. nipalensis* is only a grey phase, and, as already remarked, was perhaps founded on a hybrid. There is, however, one variety unnamed, the specimen of it in the British Museum having been received in that collection from the East India Museum after the death of Dr. Gray. In this the black spots tend to form longitudinal lines and to enclose bands of rich rufous brown between them, the bands being more or less broken up into large rosettes, dark brown inside and bordered by imperfect black rings; the pale rufescent ground-colour occupies but a small portion of the surface. This is the most beautiful form I have seen. According to Mr. Blyth, there is a similar specimen in Calcutta.

The small race called *F. wagati* by Dr. Gray is, I believe, not the *Wagati* of Sir W. Elliot*, for the specimens are all labelled Moulmain, and are probably the Burmese form. Judging from comparison with a single specimen from the peninsula of India, the Burmese and Southern Indian races are very similar†, except that the latter is larger; the ground-colour in both is light with large distinct elongate black spots. *F. tenasserimensis* is founded on a flat skin, and differs in no important character. Further south in the Malay Peninsula and the Malay Islands, extending to Borneo and the Philippine Islands, is another small form, *F. minuta* v.

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* Madras Jour. Lit. Sci. x, p. 108.

† According to McMaster (Notes on Jerdon, p. 29) Burmese individuals are smaller and more richly marked than those from the Western Gháts.

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sumatrana, with smaller and more numerous rounded black spots. Some specimens appear to have a decidedly shorter tail than typical *F. bengalensis*, but others have the tail as long as in the normal form. *F. javanensis* (of Horsfield and Gray, *F. javensis* of Elliot in part) is a peculiar small grey form with very small spots, those on the back elongate but deep blackish brown rather than black, those on the sides brown. *F. jerdoni*, as represented by two specimens in the British Museum, both named by Blyth, and one of which must be considered the type, is merely a smaller form, absolutely indistinguishable from *F. javanensis* so far as markings and structure are concerned; there is no evidence of the locality whence these specimens came, but they are probably Malayan.

Habits. *F. bengalensis* is only found in forests, where it preys on birds and small quadrupeds. In Coorg, Jerdon was informed that it lived in hollow trees, and carried off poultry from villages. Jerdon also quotes Hutton to the effect that this cat breeds in May, and has only 3 or 4 young, in caves or beneath masses of rock.

All observers agree that *F. bengalensis* is excessively savage and untamable. Usually when caged it remains crouched in a corner during the daytime and snarls at all who come near. But a specimen that I have recently seen in the Zoological Gardens, Regent's Park, paced its cage, came when called by its keeper, and appeared thoroughly tame. This is the individual, already mentioned, from Jeypore in the Madras Presidency.

37. **Felis rubiginosa**. *The rusty-spotted Cat.*

Felis rubiginosa, *I. Geoffr. Bélanger, Voy. Indes Or., Zoologie*, p. 141, pl. 6 (1834); *Kelaart, Prod.* p. 47; *Jerdon, Mam.* p. 108; *Holdsworth, P. Z. S.* 1871, p. 756; *Elliot, Mon. Fel.* pl. xxix.

Namali pilli, Tamil, Madras; *Verewa puni*, Tamil, Ceylon; *Kula diya*, Cingalese.

Size smaller than that of an ordinary domestic cat. Tail about half the length of the head and body. Fur short and soft. Ears small, rounded at the end. Two upper premolars on each side; the anterior pair are wanting, as in the lynxes. The bony orbit is complete behind.

Ground-colour above and on the sides rufescent grey, below white, body and limbs spotted. Some Ceylon specimens are bright ferruginous with a slight greyish tinge only. The fur of the upper parts is hair-brown, varying in depth of shade, at the base, then pale brown; numerous longer hairs are intermixed, in which the pale brown passes into rufous brown followed by a white ring, the tip being rufous to dark brown. The spots on the back and sides are brown to pale ferruginous, darker on the back, paler and redder on the sides; all are small, somewhat elongate, especially on the back, and arranged in longitudinal lines. The spots on the belly are dark brown and larger. In the ferruginous Ceylon variety none of the spots are red, all are brownish black. Four dark lines, sometimes with one or two shorter broken bands

GSL

in the middle, run from the eyes and base of the nose over the head, almost without interruption, and the two inner are continued between the shoulders as two well-marked, elongate, slightly diverging stripes without any other spots or bands between them. Behind the shoulders the bands are continued in the form of spots, other spots intervening. Cheek-stripes and throat-bands as in other cats, but usually ferruginous, the bands outside the forearm dark brown. There is a well-marked dark band inside each eye. Ears outside brown, with a large pale spot on each. Tail rufous grey, nearly the same colour as the back above, much paler below, finely punctulated, but without any distinct spots or stripes.

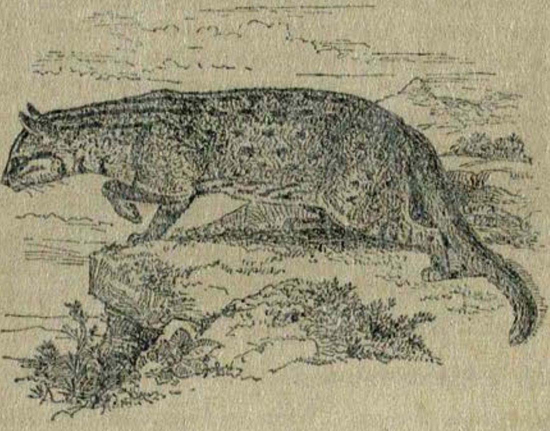

Fig. 20.—*Felis rubiginosa.* (Elliot, Mon. Fel.)

Dimensions. Head and body 16 to 18 inches, tail 9·5. A skull measures 2·55 inches in basal length and 2·05 in breadth across the zygomatic arches.

Distribution. Southern India and Ceylon. Unknown on the Malabar coast, but not uncommon in the Carnatic. Sterndale also obtained it at Seoni in the Central Provinces, but it appears to be rare so far north.

Habits. Jerdon says:—"This very pretty little cat frequents grass in the dry beds of tanks, and occasionally drains in the open country and near villages, and is said not to be a denizen of the jungles. I had a kitten brought to me when very young in 1846 and it became quite tame, and was the delight and admiration of all who saw it. Its activity was quite marvellous, and it was very playful and elegant in its motions. When it was about eight months old, I introduced it into a room where there was a small fawn of the gazelle, and the little creature flew at it the moment it saw it, seized it by the nape, and was with difficulty taken off. I lost it shortly after this. Sir W. Elliot notices that he has seen several undoubted hybrids between this and the domestic cat, and I have also observed the same."

It is doubtful whether Jerdon's information as to this cat not living in jungles is correct, for Holdsworth found it inhabiting forests in Ceylon. Sterndale had two young kittens at Seoni and fully confirms Jerdon's account of their being easily tamed, exceedingly graceful and agile. A young village cat which, after one of the pair died, he obtained as a companion to the survivor, was far inferior in activity and in its power of climbing.

Another cat that has been procured from the Malay Peninsula, Sumatra, and Borneo, and which, although not hitherto recorded from any locality further north than Province Wellesley, may possibly be found to extend into the southern portion of the Tenasserim Provinces, is *F. planiceps*, Vigors. The following description will enable this species to be recognized:—

F. planiceps. About the size of a domestic cat. Tail short, a quarter to a third the length of the head and body. Orbits completely enclosed by bone, and the anterior upper premolar larger and better developed than in any other living cat, having two roots. Colour dark rich red-brown above, the fur having a silvery speckled appearance, owing to an intermixture of hairs with white tips; below white, more or less spotted or splashed with brown.

38. **Felis manul.** *Pallas's Cat.*

Felis manul, *Pallas, Reise Russ. Reichs*, iii, p. 692 (1776); *Elliot, Mon. Fel.* pl. x.

Felis nigripectus, *Hodgs. J. A. S. B.* xi, p. 276, with plate (1842).

Size of a domestic cat. Fur soft, long and very thick. Ears short and rounded. Tail very thick, bushy, cylindrical, about half the length of the head and body.

The skull is of very peculiar shape, being remarkably broad for its length everywhere. The orbits, too, are directed forward more than in any other cat. The upper surface of the skull is highly convex. The muzzle is broad, the nasals of moderate size, slightly concave on the outer margins. The teeth are well developed, the inner lobe of the flesh-tooth very small, and in the only skull I have examined the anterior upper premolar was wanting on both sides.

Colour. Silvery grey to yellowish buff, with a silvery wash above, darker on the back; breast brown, remainder of lower parts white. Fur brown at the base, then buff or grey; ends of long hairs white with black tips on the back. Across the loins are a few more or less distinct black transverse stripes, narrow and far apart, and on the tail are 6 or 7 nearly equidistant narrow black rings and a black tip. In some specimens, too, there are a few black transverse stripes on the limbs. The head is spotted above, and there are the usual two dark horizontal stripes across each cheek.

Dimensions. Head and body of a male $18\frac{3}{4}$ inches, tail $8\frac{1}{4}$, height 9, length of ear $1\frac{3}{16}$ (*Hodgson, MS.*). A skull measures in basal length 3 inches, breadth across zygomatic arches 2·8. Weight according to Pallas 6 to $7\frac{1}{2}$ lbs.

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Distribution. Tibet, extending into Ladák, whence there is a specimen, procured by General R. Strachey, in the British Museum collection. The species, however, does not appear to have been observed on the south side of the main Himalayan range. To the northward *F. manul* is found as far as Siberia, being common in Mongolia.

Habits. According to Pallas this cat lives amongst rocks in the deserts of Central Asia, and feeds on small animals.

39. **Felis ornata.** *The Indian desert Cat.*

Felis ornata, *Gray, Hardwicke's Ill. Ind. Zool.* i, pl. 2 (1832), bad figure; *id. P. Z. S.* 1867, p. 401; *Blyth, J. A. S. B.* xxv, p. 441; *id. Cat.* p. 63; *Elliot, Mon. Fel.* pl. xxxii; *Thomas, P. Z. S.* 1886, p. 55.

Felis servalina, *Jardine, Naturalists' Library, Felinæ*, p. 232, pl. 25 (*F. ornata* on plate).

Felis torquata, *Blyth, P. Z. S.* 1863, p. 185, *partim*; *Jerdon, Mam.* p. 110, *partim* (*nec F. Cuv.*, Chat du Nepal, *Hist. Nat. Mam.* pl. 126).

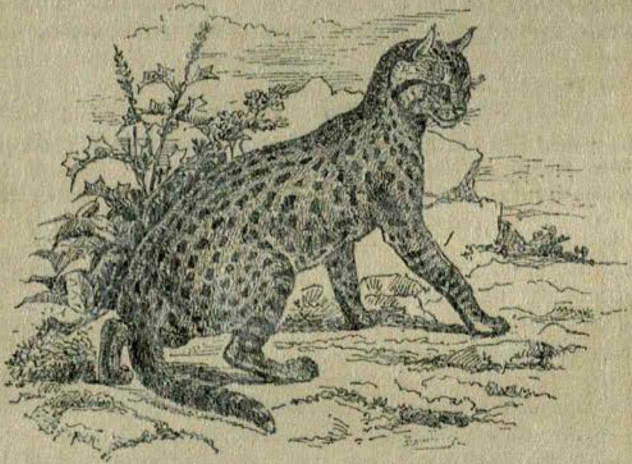

Fig. 21.—*Felis ornata.* (Elliot, Mon. Fel.)

Size of a domestic cat. Tail tapering, about half the length of the head and body. Ears well developed, pointed. Fur short.

The skull is broader and shorter than those of *F. chaus* and *F. bengalensis*. Lower edge of mandible very convex. Inner lobe of upper flesh-tooth well developed, being quite as large as the anterior outer lobe, or larger.

Colour. Very pale sandy (fulvescent grey or light isabelline), with numerous small black roundish spots on the body, and still smaller elongate spots on the crown and nape, those on the crown having a tendency to form longitudinal bands. Fur of back dusky grey near the base, thence to near the end pale rufescent, tip still paler. There are some narrow black cross lines outside the limbs, and two distinct black bars inside each forearm, also the usual cheek-stripes, which are brown. The lower parts are pale rufescent, with a few black spots; the chin, throat, and front of the breast white and unspotted, the fore neck rufescent. Ears externally the same colour as the back, with a few elongate brown hairs at the end. Tail with some black transverse bands above, which form rings towards the end; the tip is black. Paws black beneath.

Dimensions. Head and body 18 to 22 inches, tail 9 to 10, hind foot from calcaneum 4·5. Basal length of an adult female skull 3·25, zygomatic width 2·75; a smaller male skull 2·85 by 2·35. The sexes do not appear to exhibit any constant difference in size.

Distribution. Throughout the drier regions of Western India, from the Punjab and Sind to Saugor and Nágpúr, not extending, however, to the Gangetic valley, and rare south of the Nerbudda. It is common in the Indian deserts east of the Indus, in Sind, Western Rájputána, and Hurriana.

Habits. The desert cat inhabits sandy plains and sand-hills, where its principal food in all probability consists of *Gerbilli* (*G. hurrianæ*). It is not found in wooded country. It is not by any means particularly nocturnal.

According to Dr. Scott, as quoted by Blyth, this cat, like *F. rubiginosa*, *F. chaus*, and other species, breeds with domestic cats, and in some parts of the country inhabited by *F. ornata* many of the village cats are similarly spotted.

Until recently this animal was represented by but two skins, one of them immature, in the British Museum collection. It appears to be also poorly represented in Calcutta. The receipt of six beautiful specimens and skulls, obtained near Sámbhar in Rájputána by Mr. H. M. Adam, and presented to the British Museum by Mr. Hume, has served to show that *F. ornata* is a well-marked species and distinct from *F. torquata*, to which it was united by Blyth and Jerdon.

A cat much resembling *F. ornata* is found inhabiting Eastern Turkestan, and was named by me *F. shawiana*. Although nearly allied to the Indian desert cat, *F. shawiana* appears to be larger with a shorter tail.

40. **Felis torquata**. *The waved Cat.*

Felis torquata, *F. Cuv. Hist. Nat. Mam.* pl. 126 (1826); *Jerdon, Mam.* p. 110, *partim*; *Thomas, P. Z. S.* 1886, p. 55.
Felis inconspicua, *Gray, Charlesworth's Mag. N. H.* i, p. 577 (1837).
? Felis huttoni, *Blyth, J. A. S. B.* xv, p. 169; xvii, p. 247, xxii, p. 581.

Size of a domestic cat. Tail tapering, about half the length of the head and body, or rather more. Ears rounded at tips.

Skull short and high, very similar to that of *F. ornata*. The minute anterior upper premolar, instead of being placed as in *F. ornata*, *F. caligata*, and many other cats, halfway between the second premolar and the canine, is close to the former in both the skulls examined, and in one there is an additional equally minute premolar in front, close to the canine. The position of the normal anterior premolar close to the second is common in domestic cats, Indian and European.

CSL

Colour. Ash-grey, varying in some skins to brownish or rufescent, lower parts buff. Fur on back grey at the base and sometimes throughout; in other skins it becomes rufescent, always having a dark brown or blackish subterminal portion, and a whitish or yellowish tip. Narrow longitudinal dark bands, often very indistinct, run along the crown and back; and there are numerous interrupted narrow dark brown or black transverse (vertical) bands or rows of spots on the sides, extending as cross rows of spots to the anterior portion of the abdomen. There are cross bands on the fore neck; the breast and lower abdomen remaining unspotted. The usual markings are found on the cheeks. Tail with more or less distinct black rings on the posterior half and a black tip. Paws black or dark brown beneath.

Dimensions. A male obtained in Kashmir measured—head and body 22 inches, tail 12. A female from Rájputána measured—head and body 20 inches, tail without hair at the end 10, with 10½, ears 2 outside, hind foot 4·9. In the fully adult skull of the latter the basal length is 2·95, zygomatic breadth 2·4.

Distribution. The type of *F. torquata* was said to be from Nepal; the exact locality of *F. inconspicua* is not recorded, but specimens precisely similar have been obtained by Captain Boys and Mr. Adam in Rájputána, and by Sir O. B. St. John in Kashmir. This cat must therefore be widely dispersed throughout Northern India, though it does not appear to be common.

Nothing especial is known of the habits, and it is far from improbable that specimens of the present form are merely descendants of tame cats that have run wild. The converse is, however, equally probable, that this is the aboriginal race from which Indian domestic cats, and possibly those of other countries are derived; and the circumstance that skins from parts of India so distant from each other as Nepal, Rájputána, and Kashmir are precisely similar is in favour of the latter view. The characters of the upper premolars distinguish *F. torquata* from the allied *F. caffra* (or *F. caligata*), to which, however, *F. huttoni*, described by Blyth from Afghanistan, may perhaps belong.

41. Felis chaus. *The jungle Cat.*

Felis chaus, *Güldenstädt, Nov. Com. Pet.* xx, p. 483, pls. 14, 15 (1776); *Kelaart, Prod.* p. 48; *Blyth, Cat.* p. 63; *id. P. Z. S.* 1863, p. 186; *id. Mam. Birds Burma*, p. 28; *Jerdon, Mam.* p. 111; *Elliot, Mon. Fel.* pl. xxxiii.
Felis catolynx, *Pallas, Zoog. Ros.-As.* i, p. 23, pl. ii.
Felis affinis, *Gray, Hardwicke's Ill. Ind. Zool.* i, pl. 3.
Felis kutas, *Pearson, J. A. S. B.* i, p. 75.
Felis (Lynchus) erythrotis, *Hodgson, J. A. S. B.* v, p. 233.
Felis jacquemontii, *I. Geoffr. Jacquemont, Voyage*, iv, p. 58, *Atlas*, ii. pls. ii, iii.

Jangli-billi, H.; *Khatás*, H. and Beng.; *Banberál*, Beng.; *Gúrba-i-Kuhi*, Pers.; *Bául, Bháoga*, Mahr.; *Berka*, Hill-tribe of Rajmahál; *Mant-bek*, Can.; *Kada bek* or *Bella bek*, Wadári; *Katu-punai*, Tam.; *Jurká pilli*, Tel.; *Cherru puli*, Mal.; *Kyoung tset-kün*, Arakanese.

GSL

Size exceeding that of a domestic cat. Pupil round. Ears often with a few longer hairs at the end, not amounting, however, to a distinct tuft as in the lynxes. Tail short, one third to two fifths the length of the head and body. Fur variable, short in specimens from plains of India, longer in Himalayan skins.

Skull strong, elongate, postorbital processes bending sharply downwards; the brain-case broad behind the postorbital processes; nasal bones broad anteriorly, more or less concave at the side. The lower jaw convex below. Inner lobe of upper flesh-tooth well developed, as large as the outer anterior lobe.

Colour of the body varying from sandy grey or yellowish grey to greyish brown; back darker, often rufescent, sometimes dusky; lower parts fulvescent or rufescent white. Fur in general fulvescent white (isabelline) from the base to near the tip, where it is greyish white, the tip being black, sometimes on the back rufous near the tip; the underfur near the body in some specimens brown. The limbs are sometimes transversely barred with dusky, sometimes not; there are usually the two broad dusky bands inside the forearm. Foot and tarsus dusky brown beneath. Tail ringed with black near the end, and the tip black. Cheek-stripes and band across breast sometimes present and of a pale ferruginous tint. Ears pale rufous outside, the tips generally blackish or black. There is some long whitish hair on the anterior portion of the ear inside.

In adult specimens there are usually no markings on the body or limbs, but exceptions occur. In some skins more or less distinct vertical rows of spots or wavy lines may be traced on the sides. A black variety is occasionally found, and Dr. Scott procured it both near Hansi and in the neighbourhood of Umballa.

Dimensions. Hodgson gives:—head and body 22 inches, tail with hair at the end 11, without 10, height at shoulder 16; weight 14 lbs. Jerdon's measurements are:—head and body 26, tail 9 to 10, height at shoulder 14 to 15; and of a large specimen killed at Umballa, total length 39 inches, height 18, weight 18 lbs. (Appendix, p. ii). A moderate-sized skull is 3·75 inches long (basal length), and nearly 3 broad across the zygomatic arches. In a large male skull the basal length is nearly 4 inches, in a small (? female) specimen 3·35.

Distribution. F. chaus is the common wild cat of India from the Himalaya to Cape Comorin, and from the level of the sea to 7000 or 8000 feet or perhaps higher on the Himalayas. It is found in Ceylon and also extends into Burma, but has not been recorded further east. A wild cat observed by Col. Tickell at the Andaman Islands (J. A. S. B. xxxii, p. 86) may perhaps have been this species. It has an extensive range through Western Asia and Northern Africa.

Habits. This cat frequents either jungles or open country, and is very partial to long grass, reeds, cornfields, sugar-cane fields, and similar places, being often seen in the neighbourhood of villages. It feeds on birds and small mammals, and is said to be especially destructive to partridges, peafowl, hares, and other game,

GSL

Jerdon was actually robbed by a jungle cat of a peafowl he had shot; and McMaster relates a similar incident that happened to himself. The same observer says that he shot one in Burma in deep black mud, where it was perhaps hunting for fish or crabs. The voice, according to Blyth, differs from that of the domestic cat.

The jungle cat is a very savage animal. McMaster says he was once charged by a large individual that he had wounded with shot. As a rule, even if captured young, *F. chaus* appears to be untamable, but exceptions occur. It frequently breeds, however, with the domestic cat of India, and some of the latter closely resemble it in colouring, although they are considerably smaller. It is said to breed twice in the year, and to have three or four young at a time.

42. **Felis caracal.** *The Caracal.*

Felis caracal, *Güldenstädt, Nov. Com. Pet.* xx, p. 500 (1776); *Blyth, Cat.* p. 64; *Jerdon, Mam.* p. 113; *Elliot, Mon. Fel.* pl. xli.

Siyâh-gush (black ears), Pers. and H.; *Tsogde*, Little Tibet (? Gilgit); *Ech*, Ladák (Vigne).

Size intermediate between *F. chaus* and *F. lynx*. Build slender, limbs long. Tail one third the length of the head and body. Ears long and pointed, with a long black tuft of hair at the end.

Skull convex above, facial portion short. Teeth well developed. Anterior upper premolar wanting; inner lobe of upper flesh-tooth moderate.

Colour above varying from rufous fawn-colour to brownish rufous, generally the former in Indian specimens, unspotted; below paler rufous or white, often with indistinct rufous spots. Fur nearly the same colour throughout, slightly paler near the roots, some white tips intermixed on the back, and in darker specimens black tips also, giving a peculiar grizzled appearance. Limbs and tail the same colour as the body, the tip of the latter sometimes black, but not always. Ears outside black, often mixed with white, inside white; a blackish spot on each side of the upper lip, and others, not always distinct, above each eye and on each side of the nose. A white or pale spot inside, and another below each eye.

Dimensions. Head and body 26 to 30 inches, tail 9 to 10, ear 3, height 16 to 18 inches. Basal length of skull 4·55 inches, breadth across zygomatic arches 3·8.

Distribution. Found in the Punjab, Sind, North-western and Central India, and the greater part of the Peninsula except the Malabar coast, but rare everywhere. Ball met with it in Chutia Nagpur. Unknown in Bengal and the Eastern Himalayas, but said by Vigne to be found in the Upper Indus valley *. Outside of India this species occurs in Mesopotamia, and perhaps on the

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* Perhaps only tamed specimens; see J. A. S. B. xi, p. 759.

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highlands of Persia, in Arabia, and throughout a large part of Africa.

Habits. Very little appears to have been recorded concerning this animal in the wild state. It probably lives amongst bushes and grass, not in thick forests. It is said to prey on gazelles, small deer, hares, and birds, and frequently to capture birds as they fly off by springing upon them to a height of 5 or 6 feet from the ground. It is destructive to peafowl, floriken, cranes, and, doubtless, to partridges.

The caracal is easily tamed, and is trained to catch birds, such as peafowl, cranes, &c., and small deer, gazelles, hares, or foxes, and also to kill for sport—a favourite amusement in parts of India, according to Blyth, being to pit these cats against each other to kill pigeons out of a flock. The caracals are let loose amongst the pigeons feeding on the ground, and each cat often strikes down ten or a dozen birds before they can escape by flight. Some Indian princes are said to have kept a large number of caracals for the purpose of hunting. Vigne, who saw them used, says that their speed is, if possible, greater in proportion even than that of the hunting leopard.

Although the caracal has the long limbs, ears, skull, and dentition of a lynx, it wants the ruff, and has a fur better adapted to its tropical or subtropical haunts.

43. **Felis lynx.** *The Lynx.*

Felis lynx, *L. Syst. Nat.* i, p. 62 (1766); *Elliot, Mon. Fel.* pl. xxxix; *Scully, P. Z. S.* 1881, p. 201.

Felis isabellina, *Blyth, J. A. S. B.* xvi, p. 1178 (1847); *id. Cat.* p. 64; *id. P. Z. S.* 1863, p. 186.

Patsalan, Kishmiri.

A strongly built cat, high on the legs, with a short tail, less than one fourth the length of the head and body. Ears long, pointed, and with a long black tuft of hair at the end. Pupil round. Hair of the hinder part of cheeks lengthened and hanging down, forming a partial ruff. Fur soft, thick. Pads of feet more or less concealed by hair. Intestines shorter than in other cats, being only twice the length of the body.

Skull very convex above, the facial portion short and broad. Orbits incomplete behind. In adults there are only two upper premolars.

Colour varying from pale sandy grey (isabelline) to rufous fawn with a greyish wash, and in some (European) specimens to ferruginous red, lower parts white. In summer there are small black spots on the body, and these are persistent in some cases even in winter fur (probably in young individuals); but Asiatic specimens in winter coats are unspotted except on the flanks and limbs, and even there the markings are often wanting. The spots are evidently very variable. The fur is fawn-coloured with a more or less rufous tinge, towards the roots the hairs are brownish; the tips of the longer hairs are white, some black tips being often intermixed on the back. Terminal portion of the tail black. Ears outside grey, with the margins, tip, and terminal tuft black. Some black hairs are intermixed with the ruff, and, in some cases, there is an imperfect dark band across the throat. There are sometimes blackish or black spots on the belly.

The Tibetan lynx was distinguished by Blyth as *F. isabellina* on account of its pale colour and of the hair on the toes being shorter. Both these differences are probably due to the Tibetan lynx living in open ground amongst rocks, whilst the common lynx of Europe dwells chiefly in forests. The lynx of Gilgit, where there is some forest, is intermediate in coloration; and I can find no constant character of importance by which *F. isabellina* is distinguishable from the common lynx. Some skins procured by Hodgson from Tibet are undistinguishable from Gilgit and Turkestan specimens.

Dimensions. Head and body 33 inches, tail 7¾; weight about 60 lbs. In a skull, the basal length is 4·6 inches, zygomatic breadth 4.

Distribution. Found in the Upper Indus valley, Gilgit, Ladák, Tibet, &c., also throughout Asia north of the Himalayas, and Europe north of the Alps.

Habits. The lynx is found in Gilgit at heights above 5000 feet, but occurs at a great elevation in Tibet, Captain Kinloch having shot a female and captured the cubs near Hanle when hunting *Ovis hodgsoni*, which does not descend below 14,000 or 15,000 feet in summer. In Tibet, as in Europe, this species has the character of being extremely bloodthirsty and savage. Scully mentions that a pair of them killed six sheep in one night near Gilgit. Lynxes prey on birds and on all mammals that they are able to kill, from goats to mice; but the stories told of their attacks upon animals the size of red-deer, *Cervus elaphus*, are scarcely credible. The keenness of sight and hearing in the lynx have long been famous; the animal is well known to be an excellent climber, and to lie in wait for his prey on trees. Lynxes have two or three young at a time, and usually hide them in caves and holes amongst rocks. The young are born with the eyes not opened. Young animals are easily tamed.

Genus **CYNÆLURUS**, Wagler, 1830.

The claws only partially retractile, always remaining partly exposed. Limbs longer than in any true cats. Body slender. Skull with the infraorbital foramen on each side very small, and frequently represented by two or more foramina. Inner lobe of the upper flesh-tooth quite rudimentary.

The only species generally admitted is *C. jubatus*; a peculiar form, with woolly hair and pale spots, from South Africa, has been distinguished as *C. laneus* (*Felis lanea*, Sclater, P. Z. S. 1877, p. 532),

GSL

but there is some question as to whether this is more than an accidental variety. Other nominal species will be found recorded in books.

44. **Cynælurus jubatus.** *The hunting Leopard.*

Felis jubata, *Schreber, Säugeth.* iii, p. 392, pl. cv (1778); *Jerdon, Mam.* p. 114; *Ball, P. A. S. B.* 1877, p. 169.
Felis guttata, *Hermann, Obs. Zool.* p. 38 (1804).
Cynailurus jubatus, *Blyth, Cat.* p. 65; *Elliot, Mon. Fel.* pl. xliii.

Chita, Laggar, H.; *Yuz* and *Yuz-palang*, Pers.; *Chitra*, Gond; *Chita puli*, Tel.; *Chircha* and *Sivungi*, Canarese; *Cheeta* of many European naturalists.

As long as the common leopard or panther, but much higher and more slender. Pupil round. Ears short and round. Fur coarse, hairs of neck somewhat lengthened, hair of belly rather long and shaggy. Tail more than half the length of the head and body.

Skull much resembling that of *F. uncia* in shape, high and broad, very convex above and wide behind the postorbital processes. The facial portion short and broad, nasals broad, maxillaries short and high. Orbits incomplete behind. Opening of posterior nares broad. Anterior upper premolar generally present.

Colour from tawny (pale brownish yellow) to bright rufous fawn above and on the sides, paler below, spotted almost everywhere with small round black spots without any pale centres, and not arranged in rosettes. Chin and throat buffy white, unspotted. A black line from the anterior corner of each eye to the upper lip, and another less marked, or a row of spots in some specimens, from the hinder corner of the eye to below the ear. Ear black outside, base and margins tawny. Tail spotted above; the spots, towards the end, passing into imperfect rings.

Young covered with long hair, grey in colour, without any spots. Sterndale states, however, that on clipping the hair the spots are found on the underfur. A young animal in the British Museum is figured by Elliot, and is brownish grey on the back, chocolate-brown on the legs and lower parts, with indications of darker spots. This is, doubtless, in process of change into the colour of the adult.

Dimensions. Length of head and body about 4·5 feet, tail 2·5, height 2·5 to 2·75 (*Jerdon*). A skull is 5·35 inches long in basal length, and 4·55 across the zygomatic arches.

Distribution. The hunting leopard is found throughout Africa and South-western Asia, extending from Persia to the countries east of the Caspian and into India. In this country it occurs throughout a great portion of the peninsula, from the Punjab through Rájputána and Central India to the confines of Bengal (I once saw a skin that had been brought in by a local shikári at Deoghar, in the Southál Pergunnahs, south of Bhágalpur, and Ball saw another, under similar circumstances, at Sambalpur), and in

CSL

the Deccan. How far south in India *C. jubatus* ranges does not appear to be recorded; the animal is not found on the Malabar coast, nor, according to Jerdon, in Ceylon, and its range is probably nearly the same as that of the Indian antelope. It does not appear to be found north of the Ganges, and it occurs nowhere east of India.

Habits. Being used in the chase, and considered an important or even necessary appanage to the state of many Indian princes, the hunting leopard is eagerly sought after by the particular class of men who capture wild animals; and as only the adult is valued, its habits are well known to those who occupy themselves with capturing and training it. Their accounts are, of course, like all such descriptions by uneducated men, in all parts of the world, a mixture of observed facts and traditionary fable; but some of their most interesting statements appear to be confirmed by independent testimony. In Sterndale's 'Mammalia of India and Ceylon,' p. 202, an admirable description of the capture of two hunting leopards is quoted from the 'Asian;' whilst Jerdon describes, from his own observation, the training of a young animal brought up in captivity, and quotes from Buchanan Hamilton *, Vigne †, and W. Elliot ‡ accounts of the method in which the "chita" is used to hunt antelope. A capital description is also given by McMaster §.

The principal haunt of this feline in India is in low, isolated, rocky hills, near the plains on which live antelopes, its principal prey. It also kills gazelles, nylgai (Jerdon once observed a pair stalking some of the latter), and doubtless occasionally deer and other animals; instances also occur of sheep and goats being carried off by it (a goat was once taken away by one from my own camp in Khándesh); but it rarely molests domestic animals, and has not been known to attack men. Its mode of capturing its prey is to stalk up to within a moderate distance of between 100 to 200 yards, taking advantage of inequalities in the ground, bushes, or other cover, and then to make a rush. Its speed for a short distance is remarkable, far exceeding that of any other beast of prey, even of a greyhound or kangaroo hound, for no dog can at first overtake an Indian antelope or a gazelle, either of which is quickly run down by *C. jubatus* if the start does not exceed about 200 yards. McMaster saw a very fine hunting leopard catch a black buck (*Antilope cervicapra*) that had about that start, within 400 yards. It is probable that for a short distance the hunting leopard is the swiftest of all mammals.

This animal, according to the accounts of the men who capture it, usually passes two days, after gorging itself, in resting in its lair, and on the third day repairs to a particular tree, which forms a rendezvous for other animals of the species. On this tree it

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* The quotation is said to be from the 'India Sporting Review.'

† Travels in Kashmir, Ladak, &c. i, p. 41.

‡ Mad. Journ. L. S. x, p. 107.

§ Notes on Jerdon's Mammals of India, p. 32.

GSL

sharpens its claws, leaving marks that are recognized by the hunters, who capture the leopards by means of nooses made from the dried sinews of antelopes, and pegged to the ground around the tree. From the few accounts given of their habits in the wild state, it is apparent that these felines frequently hunt in pairs or families; hence, perhaps, the appearance of several at a particular spot, where they amuse themselves by playing about before going off to hunt.

As already mentioned, only adults are captured, Indian shikáris considering that the young can only be properly trained by the parents. The same view prevails in India with regard to falcons. The hunting leopard is easily tamed, about six months being required to reduce him to a complete state of obedience and to complete his training. Many of these animals, when tamed, are as gentle and docile as a dog, delighting in being petted, and quite good tempered even with strangers, purring and rubbing themselves against their friends, as cats do. They are usually kept, when tame, on a charpai or native bedstead, attached by a chain to the wall, and are not shut up in a cage. Young hunting leopards are, of course, soon domesticated, as was shown in the case of that commemorated by Jerdon. So far as I have heard, however, this animal has not been known to breed in captivity.

The method of hunting with the "chita," as described by several observers, is the following:—The leopard is hooded, so as to blindfold it; it is fastened by a thin cord attached to a leather belt round its loins or to a collar, and is taken on a bullock-cart to the neighbourhood of the antelope. The latter have no fear of the ordinary country carts, which they see daily, and there is, consequently, no difficulty in driving to within a short distance of the herd. The leopard is then unhooded and slipped, and, according to the distance at which the antelope may be, either springs towards them at once, or, taking advantage of inequalities in the ground, follows them at a run until he gets within such a distance as to enable him to make his rush with success. He usually seizes the buck, if there is one with the herd, but this is probably due to the fact that the buck is generally the last; and, as pointed out by Sir W. Elliot, the mir-shikáris (keepers) always endeavour to get the herd to run across them, when they drive on the cart and unhood the "chita." The leopard rushes at the antelope and fells it, it is said, by striking its legs from under it with his paw; he then seizes the quarry by the throat, and holds it until the keepers arrive. The antelope's throat is then cut, and some of the blood collected in the wooden bowl from which the hunting leopard is fed, and offered to the latter, who laps it eagerly, advantage being taken of the opportunity to slip on his hood again. A good hunting leopard is said sometimes to capture four bucks in a morning.

Baldwin, in the 'Large Game of Bengal,' states that the hunting leopard has occasionally been speared from horseback. It gives but a short run, and rarely shows fight. McMaster also relates an instance of this animal being speared, and states that the hunting leopard, although at first it far outpaced the horse, was easily caught, and tried to hide in a bush, out of which it was put and speared easily.

Family VIVERRIDÆ.

The second family of the Æluroidea contains the civets, paradoxures or tree-civets, ichneumons or mangooses, and their allies, a much more diversified assemblage than the *Felidæ*. In the *Viverridæ* the head and body are more elongate, the muzzle more produced, the limbs shorter in proportion, and the teeth of the molar series more numerous than in the cats. All Indian forms have four premolars on each side above and below, one or two true molars, five toes to each foot, and a long tail. The claws vary in retractility, and so does the extent to which the tarsus and metacarpus are clad with hair beneath, this again depending upon the circumstance that some types, like *Viverra* and *Prionodon*, are truly digitigrade, whilst others, as *Arctictis* and *Paradoxurus*, are more or less plantigrade. Many of the genera have peculiar anal and preanal glands, the secretion from which is highly odoriferous.

The auditory bulla is externally constricted and internally divided by a septum, which is conspicuous from the meatus. An alisphenoid canal is present, except in *Viverricula*.

Further details of the anatomy will be found in Prof. Mivart's papers already quoted (P. Z. S. 1882, pp. 145, 459).

No representatives of this family exist in America or Australia, all being confined to the warmer parts of the Old World, and chiefly to Africa, Madagascar, and South-eastern Asia, one species extending into Spain.

The *Viverridæ* are variously divided by different authors. In the system here followed they comprise three subfamilies, one of which, *Cryptoproctinæ*, by some considered a distinct family, consists of a single species peculiar to Madagascar. The other two are represented in India, and are thus distinguished:—

A. Claws strongly curved and more or less retractile. Auditory bulla oval or subconical, broad and truncated behind, narrow in front. Apex of paroccipital process in general projecting slightly beyond the bulla; prescrotal glands generally present .... *Viverrinæ*.

B. Claws lengthened, exserted, not retractile. Auditory bulla somewhat pear-shaped. Paroccipital process not projecting beyond bulla, but spread out, and in adults lost on its posterior surface. No prescrotal glands.. .... *Herpestinæ*.

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Subfamily VIVERRINÆ.

African and Oriental forms both occur in this subfamily, but the latter are more numerous. The following genera are found within our area:—

A. Ears not tufted; tail not prehensile.
  a. Tarsus and metatarsus hairy behind; tail with dark and light rings.
    a′. Two upper true molars; a black gorget.
      a″. An erectile black dorsal crest............ VIVERRA.
      b″. No crest............................ VIVERRICULA.
    b′. One upper true molar; no gorget .... PRIONODON.
  b. Tarsus half naked behind; tail (in Indian species) not ringed.
    a′. Teeth large; a naked preanal (in males prescrotal) glandular tract .... PARADOXURUS.
    b′. Teeth small; no naked preanal or prescrotal tract .... ARCTOGALE.
B. Ears tufted; tail prehensile; tarsus naked behind ARCTICTIS.

Genus **VIVERRA**, Linn., 1766.

A crest of elongate and erectile black hairs along the middle of the back. Feet truly digitigrade, the metatarsus, metacarpus, and feet being hairy throughout, with the exception of a central and five toepads on all feet and a metacarpal pad on each fore limb.

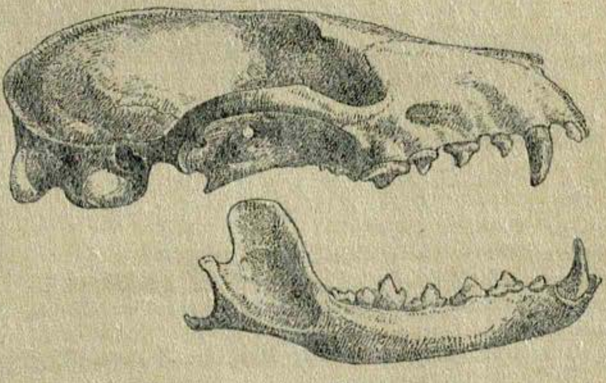

Fig. 22.—Skull of *Viverra zibetha*.

Claws small, partially retractile, and blunt. Pupil vertical. Female with three pairs of ventral teats. Fur coarse. One or more black bands across the throat; tail ringed. All the species are larger than a domestic cat. None are known to be arboreal in their habits.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{2-2}{2-2}$. The teeth are strong and the hinder teeth in the molar series broad; the inner lobe of

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the upper sectorial very large, nearly equal to the hinder lobe in size. The true upper molars are well developed. The lower sectorial has a large talon with two large inner and two small outer tubercles. The milk-dentition is figured by Mivart (P. Z. S. 1882, p. 155).

Vertebræ: C. 7, D. 13, L. 7 (or D. 14, L. 6), S. 3, C. 22–30.

This and the next genus comprise the true Civet-cats, from which the substance known as civet, largely used as a perfume, is obtained. It is the secretion of a pair of glands found in both sexes, just in front of the scrotum in the male, and in a corresponding position in the female. The secretion escapes by a number of minute orifices into a large sac, the external opening of which appears as a longitudinal slit, resembling a large vaginal aperture *. There are also two glands surrounding the anus, the secretion from which has a very different and extremely offensive odour. Various kinds of civet-cats, belonging to this and the next genus, are kept in small cages in some countries, and the civet collected from the pouch periodically; but I am not aware whether this is done anywhere in India.

Synopsis of Indian and Burmese Species.

A. No black stripe down the tail.
  a. Markings on sides indistinct or wanting ..... *V. zibetha*, p. 96.
  b. Large transverse dark marks on sides ...... *V. civettina*, p. 98.
B. A black stripe down upper surface of tail.
  a. Large dark tail-rings not interrupted below .. *V. megaspila*, p. 99.

Remains of two species of *Viverra*, *V. bakeri* and *V. durandi*, the last-named larger than any existing civet-cat, have been found in the Pliocene beds of the Siwalik hills.

45. **Viverra zibetha** †. *The large Indian Civet.*

Viverra zibetha, *L. Syst. Nat.* i, p. 65 (1766); *Schreb. Säugeth.* iii, p. 420, pl. cxii; *Blyth, J. A. S. B.* xxxi, p. 331; *id. Cat.* p. 45; *Jerdon, Mam.* p. 120.

Viverra undulata, *Gray, Spic. Zool.* p. 9, pl. 8.

Viverra sp., *M'Clelland, Calc. Journ. N. H.* i. p. 56, pl. i.

Viverra orientalis, *hodie* melanurus, *Hodgson, Calc. Journ. N. H.* ii, p. 47.

Viverra melanurus *et* civettoides, *Hodgson, J. A. S. B.* x, p. 909, xi, p. 279 (no descriptions).

Khatás, Hindi (used for several other animals also); *Mach-bhondar*, *Bágdos*, *Pudo-ganla*, Beng.; *Bhrán*, Nepal Terai; *Nit biralu*, Nepal; *Kung*, Bhot; *Saphiong*, Lepcha; *Kyoung-myeng* (horse-cat), Burmese; *Tangalong*, Malay.

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* Hodgson, Calc. Journ. N. H. ii, p. 54, pl. i, f. 1, 2; Mivart, P. Z. S. 1882, p. 147.

The figures representing this species and *V. megaspila* in Sterndale's 'Natural History of the Mammalia of India' are apparently taken from other animals. The first figure much resembles the African *V. civetta*.

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Ears small, rounded. Tail thick, scarcely tapering, more than half as long as the head and body. A crest of longer black erectile

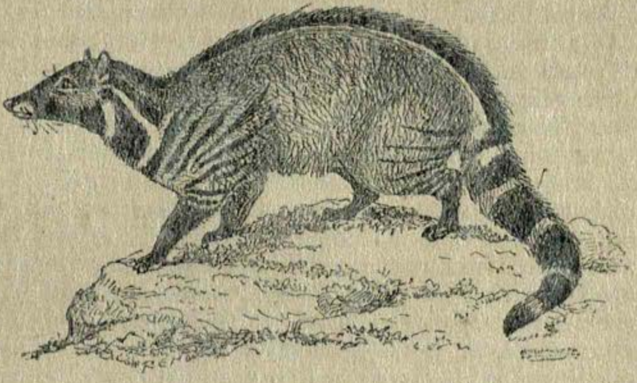

Fig. 23.—*Viverra zibetha.* (From Hodgson's drawings.)

hairs along the back from shoulders to insertion of tail. The scent-glands, when dissected out, are each 2·5 inches long by 1·5 broad.

In the skull the bony palate is continued about a quarter to half an inch behind a line joining the last upper molars, the termination being concave. Nasals short. Mandible convex below. Last upper molar one and a half times as broad as long, but last lower molar much longer than broad.

Colour. General coloration dark hoary grey, with often a brownish or yellowish tinge. Underfur brown; terminal portion of the longer hairs white with black tips on the upper part of the body. A black stripe, corresponding to the erectile crest, from between the shoulders to the first dark tail-ring, but not down the tail, which is completely surrounded by six broad black rings, the last terminal, all much broader than the white rings between them. A pale band borders the black dorsal line on each side, especially towards the rump. Sides of the body generally without markings; sometimes, however, indistinct spots and imperfect ocelli occur, forming wavy transverse bands on the sides, and longitudinal bands separated by narrow whitish lines on the loins. Legs indistinctly barred outside near the body, all the distal portions and the feet dark brown or black. Head grey; chin brown; a dark spot behind the ear; hind neck much mixed with black; front and sides of neck and upper breast white, crossed by a broad black gorget, and generally, but not always, by a narrower band in front and another behind; the hindmost meets a horizontal band running back from behind the ear along the side of the neck.

In a half-grown British-Museum specimen from Nepal the black dorsal band appears to extend in front of the shoulders. The coloration otherwise resembles that of the adult.

Dimensions. Head and body in an adult male 32 inches, tail 18, ears 2, height about 15; weight 18 to 25 lbs. A skull measures 5·25 inches in basal length, 2·7 in zygomatic breadth.

Distribution. Bengal, Assam, Burma, the Malay Peninsula, Siam, and Southern China. The range extends south and south-west of Bengal to Orissa and Chutia Nagpur, and probably some distance further south and west, and to the northward into Sikhim and Nepal, ascending the Himalayas to a considerable elevation.

Habits. The civet-cat is generally solitary. It hides in woods, bushes, or thick grass during the day, wandering into open country and often coming about houses at night. Not unfrequently it is found in holes, but whether these are dug by it is doubtful. It is said to be very destructive, killing any birds or small mammals it can capture, and often attacking fowls, ducks, &c., but also feeding on snakes, frogs, insects, eggs, and on fruits and some roots. Hodgson found in the stomachs of those he examined remains of fowls (evidently taken from a refuse-heap near a kitchen), rats, shrews, and frogs. Civet-cats take readily to water.

V. zibetha breeds in May or June, and has three or four young, which, according to Hodgson, are probably born with the eyes open. The period of gestation is not known. Hounds and all dogs are said to be greatly excited by the scent of this civet, and will leave that of any other animal for it.

Hodgson's species *V. melanura* was the uniformly coloured variety, *V. civettoides* that with transverse bars. In his drawings is the figure of a third form, said to have been brought from Tibet, covered on the body with small ocelli. I have a somewhat similar specimen, perhaps Tibetan, but less ocellated; it is probably the form said to be brought from the Chinese border of Tibet and called Kung by Tibetans (J. A. S. B. xxiv, p. 237).

46. **Viverra civettina.** *The Malabar Civet-Cat.*

Viverra civettina, *Blyth, J. A. S. B.* xxxi, p. 332 (1862); *id. P. Z. S.* 1864, p. 484; *id. Cat.* p. 44; *Jerdon, Mam.* p. 121.

"Dusky grey, with large transverse dark marks on back and sides; two obliquely transverse dark lines on the neck, which, with the throat, is white; a dark mark on the cheek; tail ringed with dark bands; feet dark. Size of the last (*V. zibetha*) or nearly so." (*Jerdon.*)

I have been unable to examine a specimen of this civet; but Mr. W. L. Sclater, who has recently compared the type with *V. zibetha*, writes to me that *V. civettina* is distinguished by having the hinder parts of the body covered with distinct large spots, and by the black rings of the tail being united by a black band above. This quite bears out Blyth's description. The large upper true molar in *V. civettina* is more quadrangular, 0·36 inch long by 0·4 broad, in *V. zibetha* 0·32 by 0·4; and in the lower jaw of the former the

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first and second premolars are close together, in the latter widely separated.

The area inhabited by *V. civettina* is separated from that occupied by *V. zibetha* by a broad tract of country, there being no civet known to occur in the Central Provinces, Deccan, or Carnatic. It is therefore probable that *V. civettina* is a distinct species. The following account of its distribution is from Jerdon:—

"The Malabar civet-cat is found throughout the Malabar coast, from the latitude of Honore (Honawar) at all events to Cape Comorin, and very possibly it extends further north. It inhabits the forests and the richly wooded low land chiefly, but is occasionally found on the elevated forest-tracts of Wynaad, Coorg, &c. It is very abundant in Travancore, whence I have had many specimens. It is not recorded from Ceylon, but most probably will be found there. I have procured it close to my own house at Tellicherry, and seen specimens from the vicinity of Honore. I never obtained it from the Eastern Gháts nor from Central India. It is stated by the natives to be very destructive to poultry."

47. **Viverra megaspila.** *The Burmese Civet.*

Viverra megaspila, *Blyth, J. A. S. B.* xxxi, p. 331 (1862); *id. P. Z. S.* 1864, p. 484; *Günther, P. Z. S.* 1876, p. 428, pl. xxxvii.
Viverra tangalunga, *Cantor, J. A. S. B.* xv, p. 197, *nec Gray.*

Kyoung-myeng, Burm.; *Músang-jebat*, Malay.

Tail less than half the length of the head and body, tapering. A band of erectile black hairs along the back, sometimes but not always less developed than in *V. zibetha.*

Bony palate extending nearly half an inch behind a line joining the last upper molars; termination very concave. The teeth larger and broader than in *V. zibetha*; hinder upper molar oval, not much broader than long; hinder lower molar very little longer than broad, and larger than that in *V. zibetha.*

Colour. Grey, sometimes with a yellowish or brownish tinge (the figure in P. Z. S. is too brown), scarcely paler below; underfur pale brown to whitish, the tips of the longer hairs grey or black. A black line down the back from the shoulders continued down the tail, which is ringed with dark brown or black; the proximal rings about the same breadth as the whitish interspaces, and (except sometimes the first) extending round the tail. Terminal portion of tail for a varying distance (sometimes half the length) black. Sides with spots, usually distinct, larger than in *V. zibetha* or *V. tangalunga* (about three quarters of an inch in diameter), tending to form transverse bands on the sides and longitudinal on the rump. Feet brown. Head grey; base of ear behind a little darker; hind neck dusky; chin brown; neck white in front and on sides, with two or three black gorgets, the anterior just behind the brown chin often wanting, the second well marked

GSL

across the throat, the third faint on the upper breast, but distinct on the side of the neck, where it runs forward to behind the ear.

Dimensions. A large individual measured 37 inches from nose to the root of the tail; tail 17·5 inches. Basal length of skull about 5·2 inches, zygomatic breadth 2·9.

Distribution. Burma, Malay Peninsula, Cochin China, and Sumatra. Recorded as far north as Prome.

Habits. Similar to those of *V. zibetha.* This civet is said by Cantor to have from one to three young at a time.

Viverra tangalunga, Gray, inhabits Java, Sumatra, Borneo, the Philippines, and, it is said, Malacca, but this requires confirmation. The only other species of the genus is the African *V. civetta.*

Genus **VIVERRICULA**, Hodgson (1838).

No erectile mane along the back; nails sharper and more curved than in *Viverra*; pollex and hallux shorter and more remote from the other toes. Foot and toepads precisely as in *Viverra.* The build is slighter, the size much smaller, the muzzle finer, and the whole animal more adapted for arboreal and climbing habits. The anal and prescrotal glands are similar.

In the skull there is, as a rule, no alisphenoid canal, although one is very rarely present. The anterior portion of the bulla in front of the constriction is much more swollen than in *Viverra*, so that the bulla looks considerably longer; the paroccipital process, too, seldom projects at all from the hinder part of the bulla, being generally rounded off against it. The teeth are small, compressed, and sharp, the formula being the same as in *Viverra.*

Vertebræ: C. 7, D. 13, L. 7, S. 3, C. 25.

The absence of an erectile mane, and the differences in the skull and structure of the feet, appear to justify the separation of the present genus, which resembles *Viverra* in its other characters. There is but a single species.

48. **Viverricula malaccensis.** *The small Indian Civet.*

Viverra malaccensis, *Gmel. Syst. Nat.* i, p. 92 (1788); *Jerd. Mam.* p. 122.

Viverra indica, *Geoffr., Desm. Nouv. Dict.* vii, p. 170 (1817); *Elliot, Mad. Journ. L. S.* x, p. 102.

Viverra bengalensis *and* V. pallida, *Gray, Hardwicke's Ill. Ind. Zool.* i, pl. 4; ii, pl. 6.

Viverra rasse, *Horsf. Res. Java*, pl.

Viverricula indica *and* V. rasse, *Hodgson, A. M. N. H.* i, p. 152 (1838).

Viverricula malaccensis, *Blyth, Cat.* p. 45; *Anderson, Zool. An. Res.* p. 166; *Thomas, P. Z. S.* 1886, p. 55.

Mashk-billa, Katás, H.; *Gandha gokal, Gando gaula*, B.; *Sogot*, Ho Kol; *Jowádi manjúr*, Mahr.; *Saiyar, Bag-myúl*, Nepal Terai; *Púnagin bek*, Can.; *Púnagú pilli*, Tel.; *Uralawa*, Cing. This animal is also called

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Kasturi, a name properly belonging to the musk-deer, in parts of India. *Koung-ka-do*, Burmese; *Wa-young-kyoung-byouk*, Arakan.

Tail tapering, about two thirds to three quarters the length of the head and body. Ears short and rounded. Fur harsh and rather coarse. Teats 6, ventral. Pupil vertical.

In the skull the nasals are of moderate length, terminating posteriorly in front of a vertical plane passing through the anterior extremities of the orbits; the occipital crest is greatly developed. Bony palate extending back some distance behind the posterior molars. Mandible convex below.

Colour. Brownish grey to pale yellowish brown, with usually several longitudinal black or brown bands on the back and longitudinal rows of spots on the sides. In some specimens both lines and spots are indistinct, and the dorsal bands are occasionally wanting; but usually there are five or six distinct bands on the back and four or five rows of spots on each side. Neck-markings rather variable; generally there are two dark stripes from behind the ear to the shoulders, and often a third in front, crossing the throat. A dusky mark behind each ear and one in front of each eye. The head grey or brownish grey; chin often brown. Feet brown or black. Tail with alternating black and whitish rings, seven to nine of each colour. The underfur brown or grey (often grey on the upper parts of the body and brown on the lower); coarser hairs with long grey, brown, or black terminations, the grey hairs on the upper parts often tipped with black.

Dimensions. Head and body 21 to 23 inches, tail (including the hair at the end, which is about an inch long) 15 to 17, ear 1 to 1½ long outside, height about 9; weight 5 to 6 lbs. A male skull measures 3·75 inches in basal length, 1·75 in zygomatic breadth; another 4 by 1·8.

Distribution. Throughout India, except in Sind, the Punjab, and the western parts of Rájputána. A specimen was obtained by Mr. Adam at Sámbhar. Also found in Ceylon, Assam, Burma, Southern China, the Malay Peninsula, Java, and some of the other Malay islands. This species likewise inhabits Socotra, the Comoro Islands, and Madagascar, but has probably been introduced, having been carried thither caged as a producer of civet.

Habits. The small civet inhabits holes in the ground, or under rocks, or thick bush, but appears not to have been observed in forest, although it is said to climb well and to be distinctly arboreal in its habits. It comes near human habitations, and has been met with taking refuge in drains and outhouses. It is frequently kept in confinement, and becomes perfectly tame. Jerdon states that he kept several, which caught rats, squirrels, and birds, and he adds that this species is kept by natives for the purpose of yielding civet. The food is varied, chiefly consisting of small animals, vertebrate and invertebrate, but partly of fruits and roots. Poultry are occasionally carried off by this civet. The female has usually four or five young at a birth.

Genus PRIONODON, Horsfield, 1823.

Syn. *Linsang*, Müller, 1839.

No dorsal mane. Form slender; limbs short; head and neck long; ears short, rounded; muzzle pointed; tail very long, cylindrical. Claws perfectly retractile and sharp; thumb and hallux near the other digits. There is on the inner proximal side a supplementary lobe to the central palmar and plantar pads, separated from the other three lobes by hair in *P. pardicolor*, but not in the other species. Metatarsus and metacarpus hairy beneath. No prescrotal glands. Anal glands present. Fur soft. Female with four teats—two ventral anteriorly situated, and two inguinal. Colour fulvous, with bold black spots or markings. Tail ringed.

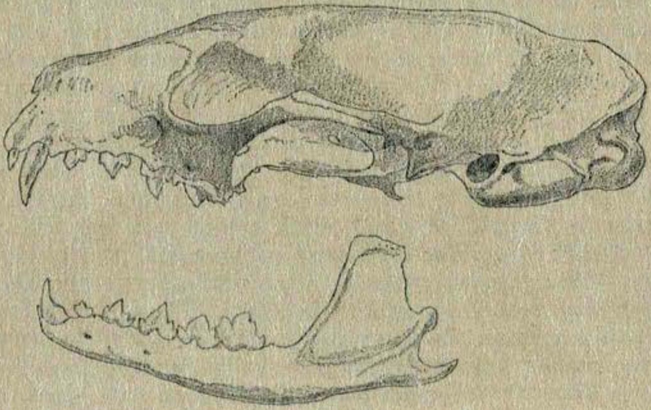

Fig. 24.—Skull of *Prionodon maculosus*.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{1-1}{2-2}$; the posterior upper molar of *Viverra* wanting. The teeth are sharp and compressed.

Of this genus two species are found within our area, a third is Malay. All appear to be carnivorous; they may also, as suggested by Hodgson, live partly upon insects. An allied genus, *Poiana*, is the representative of *Prionodon* in Africa.

Synopsis of Indian and Burmese Species.

A. Smaller; head and body about 15 inches; skull $2\frac{1}{2}$ to $2\frac{3}{4}$; back with longitudinal rows of large spots	*P. pardicolor*, p. 103.
B. Larger; head and body 18 to 20 inches, skull 3; back with broad transverse bands	*P. maculosus*, p. 104.

49. **Prionodon pardicolor.** *The spotted Tiger-Civet.*

Prionodon pardicolor, *Hodgson, Calc. Journ. N. H.* ii, p. 57, pl. i, figs. 3, 6 (1842); viii, p. 40, pl. i; *Blyth, Cat.* p. 46; *Jerdon, Mam.* p. 124; *Anderson, An. Zool Res.* p. 166.

Zik-chúm, Bhot.; *Súliyú*, Lepcha.

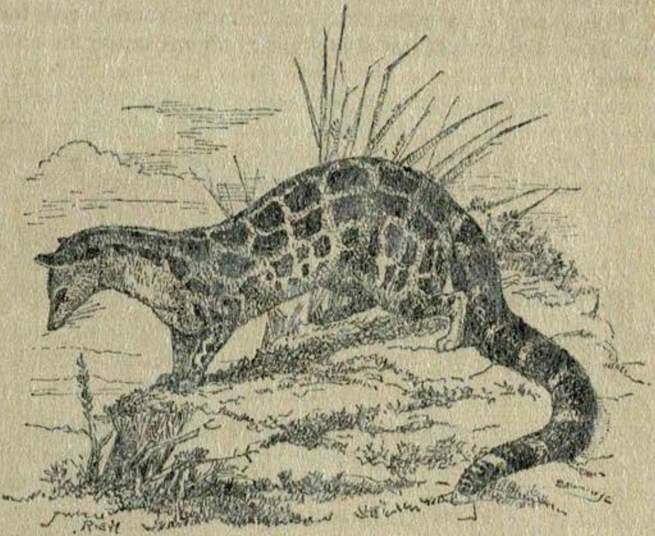

Fig. 25.—*Prionodon pardicolor.* (From Hodgson's drawings.)

Tail as long as the body and neck. Pupil round.

Skull with the zygomatic arch slight. The constriction of the bulla is very marked.

Colour. Fulvous (very pale brown), with large black spots above, whitish and unspotted below. Underfur slaty, tips of longer hairs buff or black. Head brown; frequently a black spot behind each ear. Four bands down neck, two on each side, two broader above from behind ears to between shoulders, the others lower down and more broken into spots; the two upper bands are continued as rows of large rounded spots down the back, a row of smaller irregular spots intervening, and about three more rows of spots, square or round, diminishing in size below, down each side. The spots also form about six or seven transverse rows. Limbs near the body spotted outside; feet pale brown, unspotted. Tail with about eight to ten dark rings separated from each other by the same number of pale rings, all passing right round the tail and subequal in breadth.

Dimensions. Head and body 14 to 15 inches, tail 12 to 13, height 5 to 5½; weight about a pound. Skull 2·5 inches long, 1·25 broad.

Distribution. The south-eastern Himalayas, extending thence eastward to Yunan, where it was obtained by Anderson. It is not rare in the interior of Sikhim, probably at moderate elevations.

Habits. According to Hodgson, who had one example tame, this very beautiful and graceful little animal is "equally at home on trees and on the ground; it dwells and breeds in the hollows of decayed trees. It is not gregarious at all, and preys chiefly on small birds, which it is wont to pounce upon from the cover of the grass. The times of breeding are said to be February and August, and the litter to consist of two young, there being two litters each year."

The tame specimen (a female) was "wonderfully docile and tractable, very sensitive to cold and very fond of being petted." It was fed on raw meat, and refused fish, eggs, and fruits. It never uttered any sound. The animal was perfectly free from any odour.

50. **Prionodon maculosus.** *The Burmese Tiger-Civet.*

Prionodon maculosus, *W. Blanf. P. A. S. B.* 1878, p. 71; *J. A. S. B.* xlvii, pt. 2, p. 152, pls. vi, vii (1878); *Thomas, P. Z. S.* 1886, p. 66.

Tail a little shorter than the head and body, cylindrical. Skull larger and more strongly built than that of the other species, but the anterior portion of the bulla is much less swollen than in *P. pardicolor*. The pterygoid fossæ are very broad.

Colour. Grey, with about six broad rather irregular transverse brownish-black bands across the back, much broader than the intervening pale stripes (or the back may be described as brownish black with six narrow pale bars across). The dark bands are broken up on the sides of the body, forming interrupted longitudinal dark stripes, one of which is conspicuous and runs across the shoulder to the side of the neck, and is continued by spots beneath the ear to the eye. A broader dark band down the upper part of the neck on each side from a little behind the ear to behind the shoulder, where it passes into the transverse bands; between the two upper neck-bands are a few spots, as also on the fore neck, forming an imperfect gorget, and on the outside of the limbs. Lower parts and feet pale, unspotted. Nose dark brown mixed with grey; head generally brownish grey, dark around the orbits and in front of them; and two dark streaks running back from the eye, one to the crown, the other to join the lower neck-band. Ears dark behind. Tail with seven perfect blackish rings alternating with pale interspaces, which are much narrower. Underfur ashy grey.

Dimensions. Head and body about 19 inches, tail 16 (without the hair at the end, which is less than an inch long), height at shoulder about 6, length of tarsus and hind foot 2·8, ear outside 0·65. Basal length of skull 2·9, zygomatic breadth 1·5.

Distribution. Tenasserim Provinces. One specimen was procured by Mr. Limborg east of Moulmein, a second by Mr. W. Davison at Bánkasún in Southern Tenasserim.

Habits. Unknown; probably similar to those of *P. pardicolor*.

The only other species of the genus is that first described, *P. gracilis*, a small form with nearly the coloration of *P. maculosus*, but a very different skull. This kind inhabits Java, Borneo, and, it is said, Sumatra. It was also reported from Malacca by Cantor (J. A. S. B. xv, p. 199); but, judging by the dimensions given, it is not improbable that the species obtained by him was *P. maculosus*.

Genus **PARADOXURUS**, F. Cuv., 1821.

Syn. *Paguma*, Gray; *Platyschista*, Otto.

No mane. The naked soles of the feet are joined to the foot-pads (no hairy space intervening), and extend over considerably more than half the inferior surface of the carpus and tarsus. Claws small, sharp, retractile. Pupil vertical. Tail very long, not ringed in Indian species.

All the species are nocturnal and arboreal. The food is mixed, partly animal, partly vegetable. Prescrotal and anal glands as in *Viverra*, except that the former discharge into a slight fold instead of a deep pouch, and that their secretion has little or no scent of civet. There is a well-marked tract devoid of hair, corresponding to the glands, in front of the scrotum in the male and around the genito-urinary orifice in the female. The secretion from the anal glands is in some forms singularly fetid *.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{2-2}{2-2}$; as in *Viverra*. The teeth vary much in development and somewhat in form, being large in some species and small in others. The bony palate extends back above the posterior nares in a few kinds only. The pterygoid fossa is broad.

Vertebræ: C. 7, D. 13, L. 7, S. 3, C. 29–36.

The tail is not prehensile, but the animal appears to have the power of coiling it to some extent, and in caged specimens the coiled condition not unfrequently becomes confirmed and permanent. The name *Paradoxurus* was given by F. Cuvier to a specimen with the tail thus coiled, as represented in the 'Histoire Naturelle des Mammifères,' pl. 186. Nothing of the kind, so far as I am aware, has been observed in wild examples, nor has any use of the tail for prehensile purposes been recorded. At the same time it should not be forgotten that, owing to the exclusively nocturnal habits of *Paradoxuri*, they are seldom seen in the wild state.

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* For a description of the glands see Hodgson, As. Res. xix, p. 77; Turner, P. Z. S. 1849, p. 25; also Mivart, P. Z. S. 1882, pp. 163, 519. There is also an excellent account, with figures, by Otto, Acad. Cæs. Leop. Nova Acta, xvii, p. 1095, pl. lxxiii.

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I have described the history and synonymy of this genus in the 'Proceedings of the Zoological Society' for 1885, pp. 780–808.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Bony palate not extending a quarter of an inch behind the last upper molars.
  - a. Vibrissæ black, a few of the lowest sometimes white near the base only; dorsal fur often long and ragged, with long black tips.
    - *a.* Back unstriped; no pale band across forehead .... *P. niger*, p. 106.
    - *b.* Back generally striped; a pale band across forehead .... *P. hermaphroditus*, p. 108.
  - b. Vibrissæ dark brown; general colour the same.............................. *P. jerdoni*, p. 111.
  - c. Vibrissæ rufous; general colour dull rusty red .... *P. aureus*, p. 110.
- B. Bony palate extending more than half an inch behind the last upper molars; vibrissæ white .... *P. grayi*, p. 112.

51. **Paradoxurus niger.** *The Indian Palm-Civet.*

Viverra nigra, *Desm. Mam.* p. 208 (1820).
Viverra bondar, *De Blainv. ibid.* p. 210 (1820).
Paradoxurus typus, *F. Cuv. Hist. Nat. Mamm.* pl. 186 (1821); *Elliot, Mad. Jour. L. S.* x, p. 103; *Kelaart, Prod.* p. 38 (1852).
Paradoxurus typus, P. pennantii, *and* P. bondar, *Gray, P. Z. S.* 1832, pp. 65, 66.
Platyschista pallasii, *Otto, Acad. Cæs. Leop. Nova Acta*, xvii, p. 1089, pls. lxxii, lxxiii (1835).
Paradoxurus hirsutus, *Hodgs. As. Res.* xix, p. 72 (1836).
Paradoxurus hermaphroditus, *Gray, P. Z. S.* 1864, p. 532 (*nec* Viverra hermaphrodita, *Pallas*).
Paradoxurus musanga, *partim, et* P. bondar, *Jerdon, Mam.* pp. 125, 128.
Paradoxurus niger, *W. Blanf. P. Z. S.* 1885, p. 792; *Thomas, P. Z. S.* 1886, p. 55.

Lakáti, *Chingár* (vulgarly *Khatás* and *Jhár-ka-Kutta*), H.; *Menuri*, Dakhani; *Bhám*, *Bhondar*, Bengali; *Machabba*, *Malwa*, Nepal Terai; *Togot*, in Singhbhúm; *Ud*, Mahr.; *Kera-bek*, Canarese; *Maru-pilli*, *Veruvú*, Tam.; *Manu-pilli*, Tel.; *Marrapilli*, Mal.; *Ugudora*, Cing.; *Toddy Cat* of Europeans in many parts.

Tail nearly or quite as long as the head and body, well clad with hair, slender, tapering very slightly. Fur coarse and often long, some piles, especially on the back, long and ragged; underfur short or wanting. Ventral mammæ usually six (sometimes four, according to Hodgson).

In the skull the bony palate extends but little, not more usually than about one eighth of an inch, behind a line drawn through the hinder edges of the posterior molars. Muzzle produced and

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narrow, but varying in length. Upper sectorial tooth narrow, the inner lobe small and at the distal extremity of the tooth; the inner margin of the tooth between the inner and hinder lobe distinctly concave.

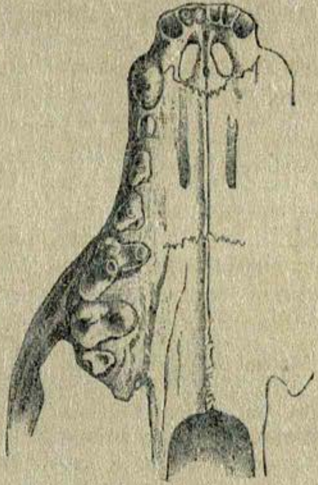

Fig. 26.—Half palate of *Paradoxurus niger*. (P. Z. S. 1885, p. 793.)

Colour. Blackish grey to brownish grey. The fur in general long, and with long ragged coarse black tips; but these are, of course, much more developed in the cold season. Underfur, when present, ashy or brownish; the longer hairs, beyond the underfur, pale grey with long black tips. As a rule there are no stripes on the back, but indistinct dark bands and rows of spots are sometimes seen, especially in young specimens. Feet and the greater part of the legs, with the terminal portion (frequently more than half) of the tail, black. The tip of the tail is sometimes white, and individuals with the feet or other parts of the body white are occasionally found. Head-markings variable; face generally black or blackish, with a distinct white or grey spot below the eye, another (generally) on each side of the nose amongst the vibrissæ, and often another above the eye. There is not, however, in this species, as usually there is in the next, a distinct whitish band across the forehead. Vibrissæ black; occasionally, but rarely, a few of the lower are whitish or white towards the base.

Dimensions. Males are larger than females. A male measured: head and body 22·5 inches, tail 19·5; a female 20 and 17·5. In another female both were about 18 inches long. An adult female skull measures 3·9 inches in basal length, 2·3 broad; a male 4·15 by 2·35; another, very large (from Nepal), 4·4 by 2·55.

Distribution. Throughout the peninsula of India, from the foot of the Himalayas, and Ceylon, wherever there are trees; equally common in the wildest forest and about human habitations. It is

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not found in the Punjab and Sind, and is rare in the bare parts of the North-west Provinces and the Bombay Deccan. Common in Upper Bengal, Southern India, and the West coast.

Varieties. Southern Indian and Ceylonese skins are blacker than those from Northern India; but I can find no other distinction between the typical *P. niger* (*P. typus* of many writers) and the form usually known as *P. bondar*, which is not nearly so yellow as Hodgson's description would lead a reader to suppose. Jerdon's description is manifestly taken from Hodgson's, and neither Blyth nor Jerdon had seen Hodgson's specimens. The *Viverra bondar* of De Blainville was founded on a drawing in Buchanan Hamilton's collection, preserved in the India Office Library. This drawing certainly represents, I think, the common Indian palm-civet.

Habits. The common palm-civet, tree-cat, or toddy-cat, is a familiar animal in most parts of India, though, being thoroughly nocturnal in its habits, it is but rarely seen in the daytime. It is arboreal, passing the day generally in trees, either coiled up in the branches, or in a hole in the trunk, and in places where cocoa-nut palms are common it frequently selects one of them for a residence. Mango-groves are also a favourite resort. It not unfrequently takes up its abode in the thatched roofs of houses; Jerdon found a large colony established amongst the rafters of his own house in Tellicherry. It is also found in dry drains and out-houses. It even occurs in large towns; I have known of one being caught in the middle of Calcutta. It is common in forest, and its presence may be detected, as Tickell observes in his MS. notes, by its droppings, rather smaller than a cat's, and always deposited on the top of the trunks of large fallen or felled trees.

The food of *P. niger* consists partly of small mammals, lizards, and snakes, birds and their eggs, and insects; partly of fruit and vegetables. This animal at times is very destructive to poultry; it is also said to do mischief in vegetable gardens. Throughout Southern India and Ceylon it is said to have an especial fondness for palm-juice or toddy, whence its popular name of toddy-cat. In confinement it will eat cooked food of almost any kind, boiled rice, vegetables, &c.

The palm-civet breeds in holes of trees, and has from four to six young. When taken young this animal is easily tamed.

52. **Paradoxurus hermaphroditus.** *The Malayan Palm-Civet.*

Viverra hermaphrodita, *Pallas, Schreber, Säugeth.* iii, p. 426 (1778).
Viverra musanga, *Raffles, Trans. Linn. Soc.* xiii, p. 252 (1822).
Paradoxurus prehensilis, P. musanga, P. dubius, P. hermaphroditus, P. pallasii, P. crossii, *and* P. finlaysonii, *Gray, P. Z. S.* 1832, pp. 65–68.
Paradoxurus quinquelineatus *and* P. musangoides, *Gray, Charlesworth's Mag. N. H.* i, p. 579 (1837).
Paradoxurus hirsutus, *Hodgs. As. Res.* xix, p. 72 (1836).
Paradoxurus nigrifrons, *Gray, List Sp. Mamm. B. M.* p. 55 (1843), no description; *id. P. Z. S.* 1864, p. 535.

Paradoxurus strictus *and* P. quadriscriptus, *Hodgs. A. M. N. H.* ser. 2, xvi, pp. 105, 106; *id. P.Z. S.* 1856, p. 396, pls. xlvii, xlviii.
Paradoxurus fasciatus, *Gray, P. Z. S.* 1864, p. 536, *nec* Viverra fasciata, *Desm.*
Paradoxurus musanga, *Jerdon, Mam.* p. 125, *partim*; *Blyth, Mam. Birds Burma*, p. 26.
Paradoxurus hermaphroditus, *W. Blanf. P. Z. S.* 1885, p. 794; *Thomas, P. Z. S.* 1886, p. 67.

Bhondar, *Bághdánkh*, Beng.; *Kyoung-won-baik*, *Kyoung-na-ga*, Burm.; *Khabbo-palaing*, Talain; *Sapo-mi-aing*, Karen; *Músang*, or *Músang Pándan*, Malay.

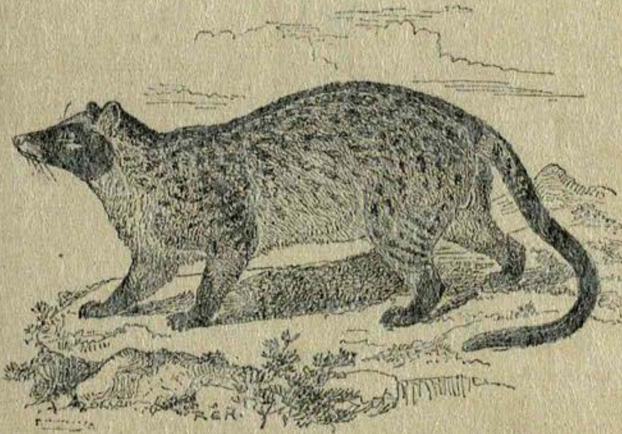

Fig. 27.—*Paradoxurus hermaphroditus.* (From a drawing by Colonel Tickell; position slightly altered.)

Structure generally much as in the last. Tail more than three quarters the length of the head and body. Fur as a rule not so long and ragged as in *P. niger*. Muzzle shorter; upper sectorial and molars larger, the former with a large inner lobe, and with the margin from the inner to the hinder lobe nearly or quite straight.

Colour. Brownish grey, sometimes ashy. Underfur, when present, brownish, the longer hairs light brown or grey, occasionally with black tips. The back is generally more or less distinctly striped longitudinally, most distinctly when the fur is short, the number of stripes varying and the lateral bands often replaced by rows of spots. Feet and terminal portion of tail (often one half or more) black; tail-tip sometimes white. Usually there is a distinct broad pale or whitish band across the forehead and in front of the ears, and as a rule this band is not crossed by black streaks, but sometimes there is a longitudinal black line in the middle and another running back from each eye. Generally a white or whitish spot occurs below the eye, and this spot sometimes is joined to the frontal band. The muzzle, including the eyes, the top of the head, with the ears and sides of the neck, are black or dark brown. The markings, however, are very variable, and occasionally either the dorsal striping or the pale frontal band is wanting; but as a rule one or the other is distinct, and serves to distinguish this from the last species. Vibrissæ black, the lowest occasionally white near the base.

Dimensions. About the same as in *P. niger.* Head and body 20 to 25 inches, tail 16 to 20. A male skull from Burma measures 3·8 inches in basal length; 2·45 in zygomatic breadth.

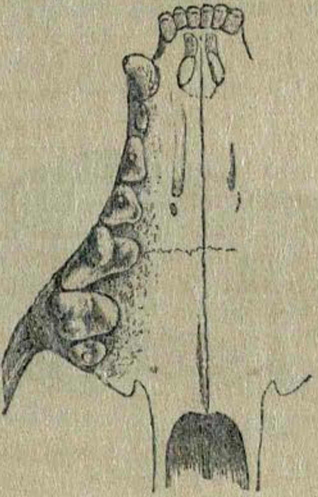

Fig. 28.—Half palate of *Paradoxurus hermaphroditus.* (P. Z. S. 1885, p. 796.)

Distribution. Throughout the countries east of the Bay of Bengal —Burma, Siam, Malay Peninsula, Sumatra, Java, and Borneo. In Lower Bengal and at the base of the Himalayas, in Sikhim and in Assam, many of the *Paradoxuri* appear to belong to this species or to be intermediate between it and *P. niger.*

Habits. Precisely the same as those of *P. niger.*

This species has been united to the last by Blyth and Jerdon, and unquestionably the two pass into each other, so that it is a mere question of convenience whether they are called species or races. As a rule the Eastern form is distinguished both by having stripes on the back and a distinct frontal band, and by its larger and differently shaped upper sectorial teeth; and as the difference is considerable, and each form fairly constant over an immense tract of country, I think it better to use different names for the two.

53. **Paradoxurus aureus.** *The Ceylonese Palm-Civet.*

Paradoxurus aureus, *F. Cuv. Mém. Mus. Hist. Nat.* ix, p. 48, pl. 4 (1822); *W. Blanford, P. Z. S.* 1885, p. 802, pl. 1.

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Paradoxurus zeylanicus, *Kelaart, Prod.* p. 39; *Gray, P. Z. S.* 1864, p. 531; *Blyth, J. A. S. B.* xx, pp. 161, 184; *id. Cat.* p. 47; *nec* Viverra zeylonensis, *Pallas, nec* V. zeylanica, *Gmelin.*

Paradoxurus montanus, *Kelaart, apud Blyth, J. A. S. B.* xx, pp. 161, 184; *id. Prod.* p. 40.

Kula-wedda, Cingalese.

Tail about four fifths the length of the head and body. Fur moderately soft and thick, of uniform length, with but little woolly underfur. Mammæ four.

Skull very similar to that of *P. hermaphroditus*; the upper sectorial tooth is larger than in the Indian form (*P. niger*), the inner lobe being very well developed. The anterior upper true molar also is broader inside, being sometimes nearly rectangular.

Colour. Uniform dull rusty red or dull chestnut, passing, however, in some specimens into a darker and browner shade. The fur and underfur are of nearly the same shade throughout; no black tips to the hairs. Faint longitudinal dorsal streaks may be detected on many specimens. A white subterminal band is occasionally found on the tail. Vibrissæ whitish in dried skins, probably rufous in fresh specimens.

Dimensions. A fully grown female, according to Kelaart, measured: head and body 19 inches, tail 15·5, height 8. Males are probably larger. A skull measures 3·85 inches in basal length, and 2·35 in zygomatic breadth.

Distribution. The island of Ceylon, apparently generally distributed, the darker specimens being from a considerable elevation.

Habits. According to Kelaart, this species is less carnivorous than *P. hermaphroditus*, specimens obtained near Newera Ellia having fed entirely on the fruit of *Physalis peruviana* or Cape gooseberry (the *Tipári* of Bengal). In other respects the habits of the two are precisely similar.

54. **Paradoxurus jerdoni.** *The brown Palm-Civet.*

Paradoxurus jerdoni, *W. Blanf. P. Z. S.* 1885, pp. 613, 802, pl. xlix; 1886, p. 420.

Kárt-nai (forest-dog), Mal.

General structure apparently as in *P. hermaphroditus*, except that the fur is of uniform length. Woolly underfur but little developed.

Skull distinguished from that of all other species by the great length of the anterior palatine foramina, which, in the only specimen examined, are over 0·4 inch long and extend back as far as the hinder edges of the anterior pair of upper premolars. Teeth larger than in ordinary specimens of *P. hermaphroditus.*

Colour. Rich deep brown on head, shoulders, and limbs, back and sides the same but grizzled. Tail brown, tip often white. Fur and underfur brown, except a long subterminal grey ring on the longer hairs of the back and sides. Vibrissæ dark brown.

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Dimensions. Approximately the same as those of *P. zeylonensis*. Adult skull 4·2 inches long from occipital condyles, 2·5 wide across zygomatic arches.

Distribution. Only known with certainty from the Palni hills in Madura, and the Nilgiris, but probably inhabiting all the higher ranges of Cochin and Travancore.

Habits. Not known.

55. **Paradoxurus grayi.** *The Himalayan Palm-Civet.*

Paradoxurus grayi, *Bennett, P. Z. S.* 1835, p. 118; *Jerdon, Mam.* p. 128; *Blyth, Mam. Birds Burma*, p. 26; *W. Blanf. P. Z. S.* 1885, p. 803.
Paradoxurus nipalensis, *Hodgson, As. Res.* xix. p. 76 (1836).
Paradoxurus tytlerii, *Tytler, J. A. S. B.* xxxiii, p. 188 (1864).

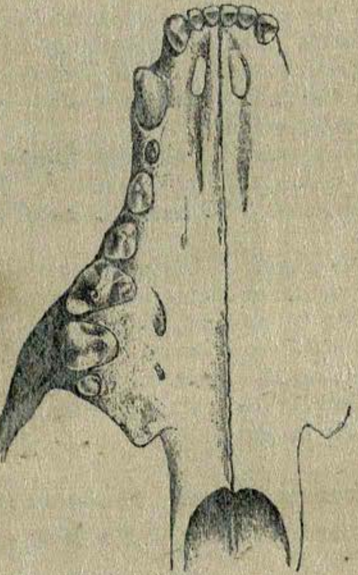

Fig. 29.—Half palate of *Paradoxurus grayi*. (P. Z. S. 1885, p. 804.)

Tail about the same length as the head and body. Fur varying in length, but much more uniform throughout the body, less harsh and more woolly than in *P. hermaphroditus*; woolly underfur frequently well developed. Mammæ 4.

In the skull the constriction behind the postorbital processes is much less than in the preceding species. The bony palate runs back above the posterior nares for 0·4 to 0·5 inch behind the hindmost molars, and is deeply concave at the end. The teeth are smaller than in *P. hermaphroditus*; the inner lobe of the upper sectorial less developed, and the first upper true molar more triangular. In old individuals the teeth, the molars especially, are much worn down.

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Colour. Grey throughout, without markings on the body, the lower parts paler and whitish. Underfur brownish grey or dusky, paler towards the base, longer hairs whitish grey towards the end, the tips on the upper parts black. Frequently, though not always, the terminal half of the tail is dusky or blackish; feet usually brown. Head, including ears and chin, brown or blackish, with the exception of the forehead, a broad band beneath each ear, a narrower line down the nose, and a blotch or spot below each eye, where white hairs are conspicuously intermixed, but there is some variation in their proportion and distribution. Vibrissæ (whiskers) mostly white, some of the uppermost black.

Some specimens have a yellowish or brownish tinge, especially on the rump, thighs, and base of the tail.

Dimensions. Head and body 24 to 25 inches, tail with hair at the end about the same; weight 9 to 10 lbs. A very old skull measures 4·4 inches in basal length, 2·7 in zygomatic breadth.

Distribution. Throughout the Eastern Himalayas in Assam, Sikhim, and Nepal, and as far west as Simla, whence a specimen was obtained by Mr. Hume. Surgeon-General L. C. Stewart informs me he shot an individual near Landour, at an elevation of 7500 feet. This species also occurs in Arakan and the Andaman Islands, but not I believe in the Peninsula of India, some reported occurrences being probably due to mistaken identification.

Varieties. Some skins in the British Museum sent by Mr. Hodgson have short woolly fur, and are of a yellowish-brown colour. I believe them to be either a variety of *P. grayi* or perhaps dyed skins. The thinness and shortness of the fur show that the specimens were derived from a warm region, probably from near the base of the Himalayas. I have similar skins from Sikhim. The skull from one of Mr. Hodgson's skins is precisely similar to those of *P. grayi.*

The Andaman form *P. tytleri* is slightly smaller in size, but does not appear otherwise to differ. The head and body, according to the describer, measured 21 inches, tail 20; a stuffed skin in the British Museum is a little larger. The skull from the latter is 4·45 inches long, 2·65 broad.

Habits. We are indebted almost entirely to Mr. Hodgson's researches for a knowledge of this animal's habits. It is more frugivorous than the common palm-civet, but, like that species, feeds partly on animal, partly on vegetable food, and captures birds and small mammals. It lives and breeds in holes of trees, four young having been found on one occasion, and it inhabits mountain forests. In the Andaman Islands the smaller variety is said to do much havoc amongst pine-apples.

This species appears to be easily tamed. A tame individual kept by Hodgson was "very cleanly, and its body emitted no unpleasant smell, though, when it was irritated, it exhaled a most fetid stench, caused by the discharge of a thin yellow fluid from four pores, two of which are placed on each side of the anal aperture," the orifices, in short, of the anal glands. McMaster in his 'Notes on Jerdon,' p. 37, relates how his servants and dogs were baffled in their endeavour to capture an animal, which he suggests may have been this species, at Russellkonda in the Northern Circars, by the singularly fetid fluid discharged by the creature. It is very possible, however, that the common palm-civet may have the same power as *P. grayi* of making itself obnoxious.

The tail was coiled, as it sometimes is in the common Indian palm-civet, in the original type of this species, a caged specimen.

Nearly allied to *P. grayi* is a still larger form, *P. leucomystax*, reddish brown in colour, with the head, except on the muzzle, paler. This is found in Malacca and the Malay Archipelago, and may possibly occur in Tenasserim *. *P. rubidus*, Blyth, J. A. S. B. xxvii, p. 275, is probably a variety of the same species.

Another form, considerably smaller than *P. grayi*, inhabits China, and was named *P. larvata* from the distinct head-markings. Both these species have the same prolonged bony palate as *P. grayi*, and all three externally resemble each other by their conspicuous white vibrissæ. By Gray they were distinguished as a genus, which he called *Paguma*.

The nature and affinities of the animal called *Paradoxurus laniger* (As. Res. xix. p. 79) by Hodgson are as obscure as its habitat. It is not quite certain that the only skin known, which is without a skull and in very indifferent condition, belongs to this genus; and it is questionable whether this specimen was obtained within the limits accepted in the present work. The following brief description may enable the form to be recognized if rediscovered. The fur consists of very thick woolly hair, without longer piles. The tail is thick at the base and tapers rapidly, it is but little more than half the length of the head and body. The soles of the feet are naked, but the toe-pads are almost surrounded by hair. There is a naked area in front of the anus. The colour is rather light rufescent brown (or greyish fawn), the hair grey at the base, light brown towards the tips, no black tips anywhere; the tail nearly the same colour throughout. The head has lost almost all its hairs. This skin was said to be from Tingri, Tibet, and evidently belonged to an animal inhabiting a cold climate (see P. Z. S. 1885, p. 807).

Genus **ARCTOGALE**, Peters, 1864.

All the teeth, except the canines, very small; those in the molar series scarcely or not in contact. The upper sectorial much rounded, the inner lobe median in position, not anterior. Palate frequently convex longitudinally between the upper sectorial teeth, the posterior portion sloping upward, and greatly produced above the posterior nares, the sides of which are arched towards each other; mesopterygoid fossa excessively narrow, less than half the breadth of the palate between the upper sectorial teeth. No pterygoid fossa.

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* There was in 1877 a specimen in the Zoological Gardens, Calcutta, presented by Mr. Rivers Thompson, and said to have been brought from the Karen Hills, Burma.

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There is no bald space in front of the scrotum or around the genital orifice; hence it is probable that the prescrotal glands, if they exist, are ill-developed. The soles are naked to a greater extent than in *Paradoxurus*, and the first digit on both fore and hind feet is more remote from the others. In other respects the two genera are similar.

56. **Arctogale leucotis.** *The small-toothed Palm-Civet.*

Paguma trivirgata, *Gray, List Sp. Mam. B. M.* 1843, p. 55; *Cantor, J. A. S. B.* xv, p. 201 (*nec* Paradoxurus trivirgatus, *Gray*, 1832).
Paradoxurus leucotis, *Blyth, Horsf. Cat.* p. 66 (1851); *id. J. A. S. B.* xxvii, p. 274; *id. Mam. Birds Burma*, p. 26.
Paradoxurus prehensilis, *Sclater, P. Z. S.* 1877, p. 681, pl. lxxi, *nec* Viverra prehensilis, *Blainv.*
Arctogale trivirgata, *Gray, P. Z. S.* 1864, p. 543; *Mivart, P. Z. S.* 1882, p. 163, figs. 8 & 9.
Arctogale leucotis, *W. Blanf. P. Z. S.* 1885, p. 789.

Kyoung-na-rwek-phyu, Arakan; *Kyoung-na-ga*, Tenasserim; *Musáng-ákar*, Malay.

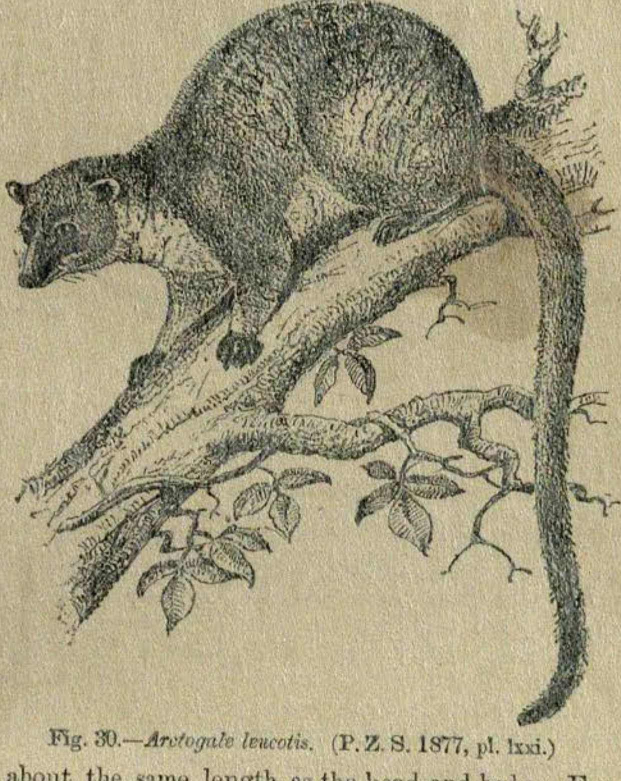

Fig. 30.—*Arctogale leucotis.* (P. Z. S. 1877, pl. lxxi.)

Tail about the same length as the head and body. Fur short, of uniform length, not harsh.

Skull narrow and elongate. Postorbital processes long, zygo-

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matic arches weak. The bony palate extends more than half an inch behind the last upper molars.

Colour. Fulvous grey (whity-brown) to dusky grey, or occasionally brown above, much paler below. Fur in pale specimens sometimes grey throughout; in darker skins brown near the base, then grey, tipped on the back with dark brown or black. Along the back run three longitudinal dark bands, either continuous or broken into spots; sometimes these bands are indistinct or wanting, but generally they are well marked. The head above, including the crown and ears, usually darker, often ashy or black; a narrow white line generally runs down the middle of the forehead and nose, or part of the distance. In Burmese specimens the tips of the ears are often whitish. Whiskers dark brown. Sides of neck pale, like the lower parts. Feet and terminal portion of tail brown or black.

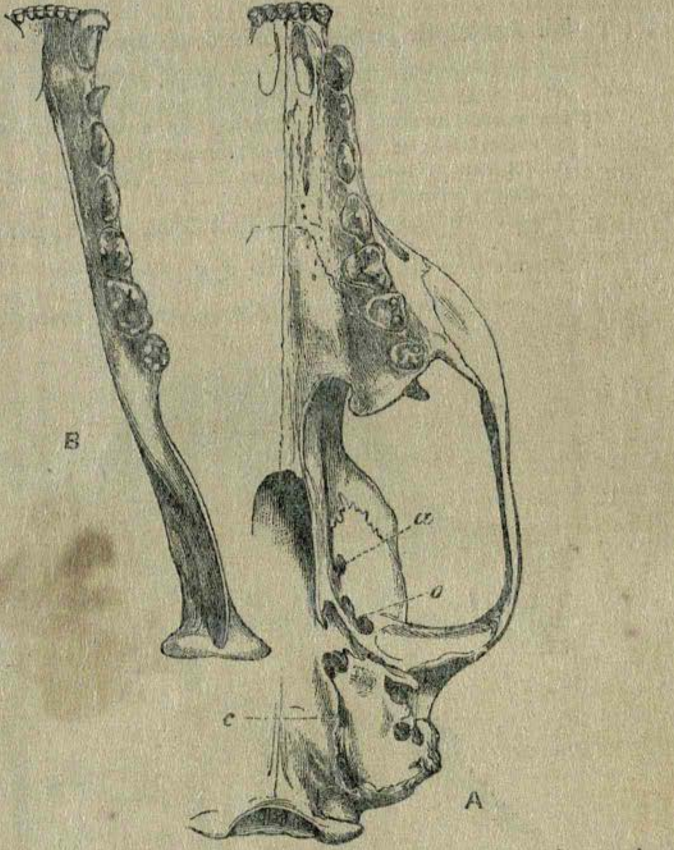

Fig. 31.—Half cranium (A) and mandible (B) of *Arctogale leucotis*, nat. size. *a*, anterior opening of alisphenoid canal; *o*, foramen ovale; *c*, carotid canal (compare fig. 15, p. 51, *ante*). (Mivart, P. Z. S. 1882.)

Dimensions. Head and body of a large male 26·5 inches, tail 27. Skull 4 inches in basal length, 2·3 in zygomatic breadth.

Distribution. This well-marked form is found east of the Bay of Bengal, from Sylhet, and, according to Sterndale, Assam, through Arakan and Tenasserim to Malacca, Sumatra, and Java. Said by Mason to be common in Tenasserim.

Habits. Nothing particular recorded. When taken young *A. leucotis* is easily domesticated. Tickell and, probably, Mason mistook the Tenasserim form of *P. hermaphroditus* for this species.

The type of Blyth's *Paradoxurus leucotis*, that originally described by Horsfield, is now in the British Museum, and is a young and pale specimen of the present form.

Hemigale hardwickei (*Paradoxurus derbyanus*), a Malayan animal allied to *Paradoxurus*, and formerly referred to that genus, is distinguished by having the soles of the feet naked to a much smaller extent, though more than in *Viverra* or *Prionodon*, and by its dentition. The coloration is very peculiar, pale brownish grey, with a variable number (usually 5 or 6) of broad, dark transverse bands on the back, longitudinal stripes on the nape, and rings on the basal portion of the tail. This animal ranges from the Malay Peninsula to Borneo.

Genus **ARCTICTIS**, Temminck, 1824.

Syn. *Ictides*, Valenciennes.

Tail long and truly prehensile. Ears short, tufted. Feet thoroughly plantigrade, the whole hinder surface of tarsus and metatarsus being naked. Claws short, half retractile, compressed, slightly curved. Fur coarse and long. Pupil vertical. Large prescrotal glands opening into a deep fold.

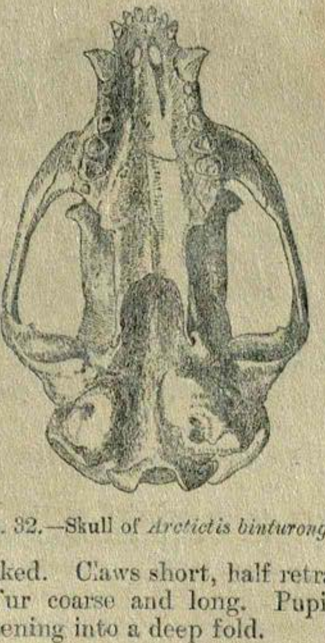

Fig. 32.—Skull of *Arctictis binturong*.

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Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{3-3}$, m. $\frac{2-2}{2-2}$; four lower premolars sometimes occur, and the last upper molar is often wanting. Canines large, compressed, very sharp behind, concave externally in front of posterior edge. Molars small, rounded; both they and the incisors are slightly separate from each other.

Vertebræ: C. 7, D. 13–14, L. 6–7, S. 3, C. 34.

Only a single species is known. A good account of the anatomy is given by Garrod, P. Z. S. 1873, p. 196, and 1878, p. 142. Flower and Mivart have confirmed the view adopted by Blyth and Jerdon, that the genus is closely allied to *Paradoxurus*.

57. **Arctictis binturong**. *The Bear-cat, or Binturong.*

Viverra? binturong, *Raffles, Linn. Trans.* xiii, p. 253.
Arctictis binturong, *Temm. Mon. Mamm.* ii. p. 308; *Cantor, J. A. S. B.* xv, p. 192; *Blyth, Cat.* p. 49; *Jerdon, Mam.* p. 130; *Blyth, Mam. Birds Burma*, p. 26.

Young, Assamese; *Myouk-kyá* (Monkey-tiger), Burmese; *Untarong*, Malay.

Tail nearly as long as the head and body, very thick at the base, clothed with bristly, long, straggling hairs, longer than those of the body. Fur coarse and long, some piles longer than the rest of the fur, especially on the back.

In the skull the bony palate runs back for a considerable distance above the posterior nares. No pterygoid fossa.

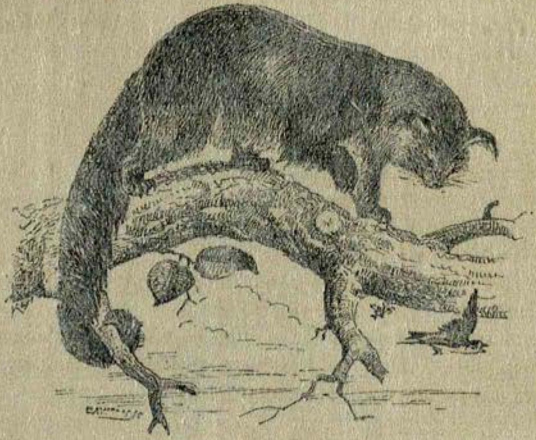

Fig. 33.—*Arctictis binturong.*

Colour. Black, more or less grizzled on the head and outside of the fore limbs, and sometimes throughout the body. Fur and underfur either black throughout or brown at the base. On the head and outside of the fore limbs, and often on the back, there is a subterminal grey or rufous-grey ring on the longer hairs. In young

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specimens there are long grey or rufous tips to the fur. The ears have a white border, but the tufts are black.

Dimensions. Head and body 28 to 33 inches, tail 26 to 27. An adult female skull measures 4·95 inches in basal length, and 2·95 in breadth across the zygomatic arches.

Distribution. From Assam, throughout Arakan, Tenasserim, Siam, and the Malay Peninsula to Sumatra and Java. The reports of this animal's occurrence in the Himalayas are of doubtful accuracy.

Habits. Like the *Paradoxuri*, *Arctictis* is omnivorous, living on small mammals, birds, fishes, earthworms, insects, and fruits; it is also nocturnal and arboreal, its power of climbing about trees being much aided by its prehensile tail. It is rather slow in its movements. Its ability to suspend itself by its tail has been questioned, but Blyth has shown (J. A. S. B. xvi, p. 864) that the young at all events can support itself by the extremity of the tail alone. Blyth also remarks that it is the only known placental mammal with a truly prehensile tail in the Old World.

This species inhabits wild forests, and, owing to its nocturnal and retiring habits, is seldom seen; it is said, however, to have a loud howl. It is naturally fierce, but when taken young is easily tamed, and becomes very gentle and playful. Of its breeding nothing appears to be known.

The only remaining member of the *Viverrinæ* found in South-eastern Asia that requires notice here is *Cynogale bennetti*, a remarkable aquatic type, somewhat resembling an otter in form. It is of a red-brown colour, with the feet webbed, and rather less naked beneath than in *Paradoxurus*, and a short tail. The teeth have long and sharp cusps, adapted for capturing fish, on which it lives. It is found in the Malay Peninsula (J. A. S. B. xv, p. 203), Sumatra, and Borneo.

Subfamily HERPESTINÆ.

Besides the characters already enumerated, most of the members of this subfamily present the peculiarity of the anus opening into a sac-like depression; but this character is ill-marked or absent in some of the common Indian species. There are several genera included, but all except one are peculiar to Africa or Madagascar. The only generic type within the Indian area is *Herpestes*, the various subdivisions, such as *Urva*, *Tæniogale*, &c., raised to generic rank by Hodgson, Gray, and others, not being distinguished by characters of more than specific importance.

Genus HERPESTES, Illiger, 1811.

Syn. *Mangusta*, Olivier ?; *Ichneumon*, Lacép. *nec* L.; *Mungos*, Ogilby; *Urva*, *Mesobema*, Hodgson; *Osmetectis*, *Calogale*, *Galerella*, *Calictis*, *Tæniogale*, *Onychogale*, Gray.

Body long and slender, limbs short, muzzle pointed. Ears very short and rounded. Tail, in most species, long and conical, being generally thick at the base, and covered with long hair. The feet are plantigrade, the extent to which the under surfaces of the tarsus and carpus are naked varying in different species, extending in some to the heel in the hind feet, whilst in others the proximal portion of the tarsus is hairy below. The fur is coarse, and the longer hairs ringed or annulated, that is marked with alternating dark and pale spaces. Toes five on all feet. Mammæ usually 3 pairs, but occasionally 2. In several species, and probably in all, there are anal glands.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{2-2}{2-2}$. Teeth of the molar series with strong, sharply-pointed cusps. Vertebræ: C. 7, D. 13, L. 7, S. 3, C. 21–29. The bony orbits in the skull are, as a rule, complete in adults, in which there is a considerable contraction in the breadth of the cranium behind the long postorbital processes. This is much less conspicuous in young skulls. The brain-case behind the postorbital process is very long, when compared with the muzzle. The bony palate is continued above the posterior nares for a long distance behind the molars; the pterygoid bones are very short, and there is no true pterygoid fossa, the pterygoid process of the alisphenoid forming a short, broad fossa that terminates posteriorly just at the posterior opening of the alisphenoid canal, close to the anterior extremity of the pterygoid itself.

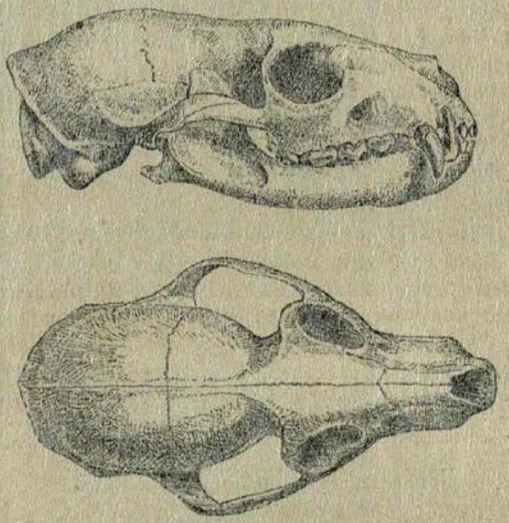

Fig. 34.—Skull of *Herpestes vitticollis*.

Some of the species of this genus are African, one, *H. ichneumon*, extending to Spain; others are Indian. The African have been recently revised by Mr. Oldfield Thomas (P. Z. S. 1882, p. 64); the Oriental by Dr. Anderson, in his 'Anatomical and Zoological Researches.' I entirely agree with the latter in his generic views;

but I am induced to carry the reduction of the number of species a little further than he does.

The Mungooses are terrestrial animals, seeking their prey on the ground, and very rarely climbing trees. They are active, bold, and predaceous, and live on small animals, mammals, birds, and reptiles, insects and eggs, occasionally eating fruit. They are deadly enemies to snakes, as described under *H. mungo.* They live in holes in the ground, hollow trees, and similar places. When angry or excited, they erect their long hairs, and especially those of the tail.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. No neck-stripe nor black tail-tip.	
a. Fur close and short, longer hairs of back with 4 or 5 rings of colour: size small.	
a'. Tarsus and hind foot without claws, under 2 inches long	*H. auropunctatus*, p. 121.
b'. Tarsus and hind foot without claws, more than 2 inches	*H. birmanicus*, p. 122.
b. Fur longer, long hairs of back with more than 5 rings; size larger.	
a'. Naked sole extending to heel. Colour grey or rufous	*H. mungo*, p. 123.
b'. Naked sole not extending to heel.	
a''. Size large; tarsus and hind foot about 3 inches. Colour dark brown grizzled	*H. fuscus*, p. 127.
b''. Size smaller; tarsus and hind foot under 2·7 inches. Colour dark brown or rufous	*H. fulvescens*, p. 127.
B. A black tail-tip, no neck-stripe	*H. smithi*, p. 126.
C. A black tail-tip and black neck-stripe	*H. vitticollis*, p. 128.
D. No black tail-tip, a white neck-stripe	*H. urva*, p. 129.

58. **Herpestes auropunctatus.** *The small Indian Mungoose.*

Mangusta auropunctata, *Hodgs. J. A. S. B.* v, p. 235 (1836).
Herpestes nipalensis, *Gray, Charlesworth's Mag. N. H.* i, p. 578 (1837); *Jerdon, Mam.* p. 136.
Herpestes pallipes, *Blyth, J. A. S. B.* xiv, p. 346 (1845); xv, p. 169.
Herpestes persicus, *Gray, P. Z. S.* 1864, p. 554; *W. Blanf. P. Z. S.* 1874, p. 662; *Anderson, An. Zool. Res.* p. 174.
Herpestes auropunctatus, *Anderson, ibid.* p. 172.

Mush-i-Khourma, Persian; *Núl*, Kashmir.

Size small. Fur short, even, close, moderately harsh, that of the tail considerably longer than that of the body. Tail, without hairs at end, about three quarters the length of the head and body. Naked sole not extending to the heel.

In the skull the pterygoid bones are not parallel, but diverge slightly behind.

Colour. Varying from light grey to dusky brown, minutely speckled with white or yellow. Lower parts paler and more uniform, or in western varieties white, and without any annulation on the hair. Dorsal fur brown at the base, then for some distance pale brownish grey or yellow, the longer hairs beyond this are blackish brown, then very pale brown or white, and, in some cases, tipped dark. Hairs of the tail with 5 to 7 alternations of pale and dark. There is some difference in the extent to which the pale and dark rings are developed; in very dark specimens the pale rings are greatly reduced in size and *vice versâ*.

Dimensions. Head and body 10 to 12 inches, tail, without hair at end, 7 to 10, tarsus and hind foot without claws 1·7 to 1·9; weight of a large male 18 ounces. A male skull measures 2·3 inches in basal length, 1·15 broad across zygomata.

Distribution. Throughout Northern India, being found in the lower Himalayas from Sikhim to Kashmir, in the North-west Provinces, Punjab, Sind, Baluchistan, South Afghanistan, and Southern Persia. To the eastward common in Lower Bengal about Calcutta, and found at Midnapur, but not recorded further south in the Peninsula. This species is found at Chittagong, and ranges through Cachar and Assam to Upper Burma, where it was procured by Anderson at Bhamo. It has not been found in Arakan, Pegu, or Tenasserim, but a single specimen, possibly imported, was obtained by Cantor in the Malay Peninsula. This is now in the British Museum, and is undistinguishable from Indian specimens.

Varieties. The Western form, found in Sind, Baluchistan, and Southern Persia, is very much paler and greyer in colour than Bengal and Himalayan skins usually are, and was distinguished by Blyth as *H. pallipes*, and by Gray subsequently as *H. persicus*. This was formerly classed separately by Anderson and myself. As, however, every intermediate gradation in colour can be found, I do not think the distinction can be maintained. The pterygoids in the skull of the pale-coloured variety are closer together anteriorly, and diverge more behind; but I can find no other difference, the discrepancies in breadth of the skull noticed by Anderson not being constant.

Habits. Nothing particular appears to have been recorded about this form, which is an active, inquisitive little animal, frequently seen in the daytime about bushes, hedgerows, and cultivated fields. The habits, so far as known, resemble those of *H. mungo*.

59. **Herpestes birmanicus.** *The small Burmese Mungoose.*

Herpestes auropunctatus birmanicus, *Thomas, A. M. N. H.* ser. 5, xvii, p. 84 (1886); *id. P. Z. S.* 1886, p. 58.

Size larger than that of *H. auropunctatus*, which this species resembles in the short, even fur and in structure generally. In the skull, the termination of the bony palate above the posterior nares is concave, and the pterygoids do not diverge.

Colour. Dark brown, minutely speckled with grey or yellowish grey throughout, lower parts very little paler than upper. Under-

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fur dark brown at the base, then whitish, the longer hairs beyond this on the back are black, then comes a yellowish ring, and the tip is black. The black tips are only found on the upper parts. On the tail-hairs the alternations of colour are more numerous.

Dimensions. Skins measure: head and body about 14 or 15 inches, tail with hair 9 or 10, tarsus and hind foot 2·2. No measurements of fresh specimens are available. The skull of a male is 2·6 inches long to the back of the occipital condyles, 1·32 broad across the zygomatic arches.

Distribution. There are in the British Museum two specimens from Burma, one collected by Captain Wardlaw Ramsay, the other obtained by Mr. Oates in Pegu: a third specimen was collected by Mr. Hume in Manipur. I have also a skin from Cachar. This species probably replaces *H. auropunctatus* in Burma and some of the other countries east of the Bay of Bengal.

60. **Herpestes mungo.** *The common Indian Mungoose.*

Viverra mungo, *Gmel. Syst. Nat.* i, p. 84 (1788).
Herpestes frederici, *Desm. Dict. Sc. Nat.* xxix, p. 60 (1823).
Herpestes malaccensis, *Fischer, Syn. Mam.* p. 164 (1829); *Blyth, Cat.* p. 51; *Jerdon, Mam.* p. 134.
Mangusta (Herpestes) nyula, *Hodgson, J. A. S. B.* v, p. 236 (1836).
Mangusta mungos, *Elliot, Mad. Jour. L. S.* x, p. 102.
Herpestes pallidus, *Wagner, Schreb. Säugeth. Supp.* ii, p. 311, pl. cxvi G; *Anderson, An. Zool. Res.* p. 181.
Herpestes griseus, *Kelaart, Prod.* p. 41; *Blyth, Cat.* p. 51; *Jerdon, Mam.* p. 132; *Stoliczka, J. A. S. B.* xli, pt. 2, p. 227; *Thomas, P. Z. S.* 1886, p. 56, note; *nec* Ichneumon griseus, *Geoffr.*
Herpestes ferrugineus, *W. Blanf. P. Z. S.* 1874, p. 661, pl. lxxxi.
Herpestes andersoni, *Murray, Vertebrate Zoology of Sind*, p. 34 (1884).
Herpestes mungo, *W. Blanf. P. Z. S.* 1887, p. 631.

Newal, Newala, Nyul, or *Newar, Dhor, Rasu,* H.; *Mangús,* in the Deccan and Southern India; *Binguidaro, Sarambumbui,* Ho Kol; *Koral,* Gond.; *Mungli,* Can.; *Mangisu, Yentawa,* Tel.; *Kiri* or *Kiripilai,* Tam.; *Kiri,* Mal.; *Mugatea,* Cing.

Hair long and somewhat ragged. Tail, without hair, a little shorter than the head and body. Tarsus naked to the heel, the hinder part of the naked sole narrow.

In adult skulls the orbit is complete behind. The bony palate extends above the posterior nares to about half the distance between the last molars and the posterior end of the pterygoids. Pterygoids parallel, not divergent.

Colour. Greyish brown, speckled with white or pale grey, sometimes with a ferruginous tinge on the head and feet. A variety is ferruginous throughout. Lower parts paler. Underfur light brown, longer hairs distinct in colour from the underfur, and marked by alternating rings of white or greyish white and dark brown, 4 or 5 of each on the hairs of the back. The dark and light rings are generally of nearly equal length, but occasionally the pale

GSL

rings are longer than the dark. The tips are often rufous brown. Claws dark brown.

Dimensions. Head and body 15 to 18 inches, tail 14 to 15; weight about 3 pounds. Males are considerably larger than females. A large skull, probably male, is 3 inches in basal length, and 1·65 in breadth across the zygomatic arches, whilst a small adult female skull measures only 2·7 inches by 1·5.

Distribution. Found throughout the peninsula of India, from the Himalayas to Cape Comorin, and also in Ceylon. *H. mungo* ranges on the west to Sind and Afghanistan, and doubtless into Baluchistan. I have a specimen of a peculiarly pale colour with very long hair from Hazára, west of Kashmir, but this species is not known to be found on the Himalayas at any elevation further east, though common near the foot of the hills. It occurs throughout Bengal, and is said to be found in Assam; but it has not been observed in Burma, and the single specimen obtained by Cantor in the Malay Peninsula may very probably have been imported, whilst the original derivation of Cuvier's type of *H. malaccensis* from Malacca is very doubtful.

Varieties. Blyth and Jerdon distinguished the Bengal race as *H. malaccensis.* This is generally darker in colour, with the head and legs more rufous, but some Bengal specimens are similar to those from Southern India, and there appears to be no constant distinction, either in colour or size. A richly ferruginous form is found in Sind, besides the common grey type, and is a well-marked variety. On account of the coloration and some apparent differences in the skull, I distinguished this as *H. ferrugineus*, but the skull characters appear due to immaturity. A very large, old example of this ferruginous variety is the type of Mr. Murray's *H. andersoni*, which he has very obligingly sent to me for comparison.

Habits. The common mungoose is found in hedgerows, thickets, groves of trees, cultivated fields, banks of streams, and broken bushy ground, but not commonly in dense forest. It is often found about houses. It lives and breeds in holes dug by itself. Very little appears to be known of its breeding-habits. It is often seen in pairs; the young are three or four in number, and are produced in the spring.

The food of this animal is varied. It lives principally upon rats and mice, snakes and lizards, such birds as it can capture, eggs and insects, but it eats fruit at times. The stomach of one killed near Secunderabad contained, according to McMaster, a quail, a small wasp's nest, a lizard (*Calotes versicolor*), a number of insects, and part of a custard apple. The mungoose is sanguinary and destructive, and when it gains access to tame rabbits, poultry, or pigeons, it, Jerdon says, "commits great havoc, sucking the blood only of several." He adds, "I have often seen it make a dash into a verandah where some cages of mynahs, parrakeets, &c. were daily placed, and endeavour to tear them from their cages."

The mungoose is easily tamed and becomes thoroughly domesticated, very much attached to its owner, intelligent and amusing. An excellent account is given by Sterndale (Nat. Hist. Ind. Mam. p. 223) of one that he had tame, and that died of grief when separated for a time from its master. The itinerant showmen, who are common throughout India, are frequently accompanied by a tame mungoose, and most of the fights between these animals and snakes that are witnessed by Europeans are waged by such tame individuals. As is so commonly the case, a tame mungoose will doubtless attack a much more formidable opponent than a wild one would. Sterndale's mungoose once attacked a greyhound, and mortally injured a male bustard, *Eupodotis edwardsi*, a bird about six times the weight of its assailant.

Much has been written about the combats between this animal and venomous snakes, and about the immunity of the mungoose from the effects of the serpent's bite. The prevalent belief throughout oriental countries is, that the mungoose, when bitten, seeks for an antidote, a herb or a root known in India as *mangusvail*. It is scarcely necessary to say that the story is destitute of foundation. There is, however, another view supported by some evidence, that the mungoose is less susceptible to snake-poison than other animals. The mungoose is not always willing to attack, though at other times he is ready enough to fight. I have not seen many combats, but so far as I can judge from the few I have witnessed, Jerdon and Sterndale are correct in their view that the mungoose usually escapes being bitten by his wonderful activity. He appears to wait until the snake makes a dart at him, and then suddenly pounces on the reptile's head, and crunches it to pieces. I have seen a mungoose eat up the head and poison-glands of a large cobra, so the poison must be harmless to the mucous membrane of the former animal. When excited, the mungoose erects its long stiff hair, and it must be very difficult for a snake to drive its fangs through this, and through the thick skin which all kinds of *Herpestes* possess. In all probability a mungoose is very rarely scratched by the fangs, and, if he is, very little poison can be injected. It has been repeatedly proved by experiment that a mungoose can be killed, like any other animal, if properly bitten by a venomous snake, though even in this case the effects appear to be produced after a longer period than with other mammals of the same size.

The mungoose is an excellent ratter, soon clearing a house of rats and mice. A tame individual in London is said to have killed, on one occasion, a dozen full-grown rats in less than a minute and a half. Within the last fifteen years the introduction of *H. mungo* into Jamaica is said to have resulted in a saving of from £100,000 to £150,000 annually, owing to the decreased number of the rats which destroy the sugar-canes (P. Z. S. 1882, p. 712).

The cry of this mungoose, according to Sterndale, is a grating mew, varied occasionally by a little querulous yelp, which seems to be given in an interrogative mood, when the animal is searching for anything; when angry it growls most audibly for so small a

GSL

beast, and the growling is generally accompanied by a bristling of the hair, especially of the tail. It is cleanly in its habits, and, after feeding, picks its teeth with its claws, a habit that has been noticed by more than one observer.

The name *H. griseus*, adopted by many authors for this species, is taken from Geoffroy's *Ichneumon griseus*, which does not, I think, belong to the Indian animal at all; whilst Gmelin's name, derived from the *Mungos* or *Viverra mungos* of Kaempfer and Linnæus, clearly by its name and description was intended for the common Indian mungoose, and has priority by more than twenty years.

61. **Herpestes smithi.** *The ruddy Mungoose.*

Herpestes smithii, *Gray, Charlesworth's Mag. Nat. Hist.* i, p. 578 (1837); *id. P. Z. S.* 1851, p. 131, pl. xxx; *Blyth, Cat.* p. 50; *Jerdon, Mam.* p. 135; *Anderson, An. Zool. Res.* p. 176.
Herpestes thysanurus, *Wagner, Münch. Gel. Anz.* ix, p. 440 (1839); *Schreb. Säugeth. Supp.* ii, p. 301.
Crossarchus rubiginosus, *Wagner, Schreb. Säugeth. Supp.* ii. p. 329.
Herpestes ellioti, *Blyth, J. A. S. B.* xx, p. 162.
Herpestes rubiginosus, *Kelaart, Prod.* p. 43.
Herpestes jerdonii *and* Calictis smithii, *Gray, P. Z. S.* 1864, pp. 550, 565.
Herpestes monticolus, *Jerdon, Mam.* p. 135.

Konda yentava, Tel.; *Erima-kiri-pilai*, Tam.; *Dito*, Cing.

Fur long, harsh, and rather ragged. Tail nearly as long as the head and body, or, including the terminal hair, longer. Naked sole beneath tarsus extending nearly to the heel but not quite.

Skull differing but little from that of *H. mungo*, except that the mesopterygoid fossa is narrower, and the pterygoids diverge slightly behind. The teeth are a little larger.

Colour. Varying from light brownish grey speckled with white as in *H. mungo*, to rufous or iron-grey, a mixture of black, ferruginous red, and white. The terminal portion of the tail, 3 or 4 inches long, jet-black, passing into ferruginous proximally, remainder of the tail concolorous with the body. Feet generally darker, rufous brown or blackish. Lower parts sometimes paler than back. Underfur grey to greyish brown, longer hairs with alternations of white and dark brown or black, usually four rings of each; tip from light brown to deep ferruginous, almost blood-red.

Dimensions. Head and body about 20 inches, tail 19. Some measurements are smaller. A male skull measures 3 inches in basal length, and 1·7 broad across the zygomatic arches.

Distribution. This species has a wide range in India, being found throughout the peninsula and Ceylon. Jerdon obtained it near Madras, near Nellore, and at the foot of the Nilgiris; Col. McMaster at Gawilgurh, Berar. Mr. Ball found it in Singhbhoom; I procured what I believe was this species in the Rájpipla hills east of Surat; there is a skin in Mr. Hume's collection from Sámbhur in Rájputána; and the type of *H. thysanurus*, which is probably the same, was a Kashmir specimen. This form has not, however, been met with in the North-west Provinces or Bengal.

Varieties. The type of *H. smithi* is a very rufous skin, whilst that of *H. jerdoni* is almost as grey as *H. mungo.* But there is much variation, and in this as in other species the amount of rufous coloration is evidently very variable. The skulls are precisely similar. The measurements also show a remarkable variation, and it is just possible that a larger and a smaller form are confounded.

Habits. Very little has been recorded. The ruddy mungoose is chiefly found in thick forests.

62. **Herpestes fuscus.** *The Nilgiri brown Mungoose.*

Herpestes fuscus, *Waterhouse, P. Z. S.* 1838, p. 55; *Jerdon, Mam.* p. 136; *Anderson, An. Zool. Res.* p. 184, pl. viii, figs. 1, 2 (skull).

Size large. Tail a little shorter than the head and body. Hair on the tail longer than on the body. Fur long, not very harsh; underfur dense, long and woolly. Naked sole not extending to the heel.

In the only skull examined the orbit is nearly perfect. The pterygoid bones are parallel and peculiarly everted, being convex inside and concave externally. The second and third upper premolars with distinct anterior cusps. Last lower molar with three anterior cusps instead of two.

Colour. Blackish brown, minutely speckled with yellow or brownish white. Tail rather darker. Feet very dark. Underfur hair-brown, longer hairs with alternating rings of blackish brown and yellow or yellowish white, three or four of each, the dark rings much longer than the light.

Dimensions. Head and body 18 inches, tail with the hair at end 17; basal length of skull 3·2, zygomatic breadth 1·95.

Distribution. The Nilgiri and Travancore hills, and probably some other hill-ranges of Southern India. Anderson adds Ceylon, but without giving any authority, and I feel doubtful whether *H. fuscus* is found there, for it appears to be replaced by *H. fulvescens.*

Habits. Very little is known of this fine mungoose except that it inhabits the dense woods upon the Nilgiri hills, where it was obtained by Jerdon. It was procured in Travancore by Mr. Baker (J. A. S. B. xxviii, p. 283).

63. **Herpestes fulvescens.** *The Ceylon brown Mungoose.*

Herpestes fulvescens, *Kelaart, J. A. S. B.* xx, p. 162 (1851), xxi, p. 348; *id. Cat.* p. 52.
Herpestes flavidens, *Kelaart, J. A. S. B.* xx, p. 184; *id. Prod.* p. 44.
Cynictis maccarthiæ, *Gray, P. Z. S.* 1851, p. 131, pl. xxxi.
Onychogale maccarthiæ, *Gray, P. Z. S.* 1864, p. 570.
Herpestes maccarthiæ, *Anderson, An. Zool. Res.* p. 178.
Herpestes ceylanicus, *H. Nevill, Taprobanian,* i, p. 62.
Ram-mugatea, Cing.

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Size of a small *H. mungo*. Naked sole not extending to the heel. Tail without the hair at the end about three quarters the length of the head and body. Fur less harsh than in most species of the genus, long, with a thick woolly underfur; hair of tail but little longer than that of body.

In the skull the orbit is imperfect (apparently from immaturity, however), and the pterygoid bones parallel.

Colour. Normally dark brown speckled with dull yellow, but some specimens are paler. Lower parts nearly as dark as upper; feet dusky. Tail the same colour as the body. Underfur brownish grey, darker near the body, the longer hairs of the back with alternating rings of pale brownish yellow and dark brown, three or four of each, the basal and terminal rings pale. Claws brown.

Dimensions. Head and body 16½ inches, tail 12¼. The skull measures 2·7 inches in basal length, and 1·45 in zygomatic breadth.

Distribution. Peculiar to Ceylon. Kelaart's specimens were from the hill-region to the south; Gray's type was said to be from Jaffna, but had evidently been kept in confinement.

Kelaart's two names *fulvescens* and *flavidens* were published in a paper read before the Asiatic Society of Bengal, March 5th, 1851 (J. A. S. B. xx, p. 287). The former occurs first, and is in every way preferable. Gray's name *maccarthiæ* was given in a paper read before the Zoological Society of London, May 13, 1851. It is clear that Kelaart's name is the earlier. Gray at first referred the species to *Cynictis*, a South-African genus of *Herpestinæ* with but four toes on each hind foot, and subsequently made *H. maccarthiæ* into a special genus *Onychogale*, apparently on account of its long fore claws, a character which, as Anderson has pointed out, was entirely due to the type having been kept in confinement.

Some skins are paler and more rufous than others, and one in the British Museum is pale sandy. The normal colour is very similar to that of *H. javanicus*, which may be distinguished by its shorter tail. *H. fulvescens* is closely allied to *H. fuscus*, which it appears to represent in Ceylon, and from which it is chiefly distinguished by its much smaller size.

64. **Herpestes vitticollis**. *The stripe-necked Mungoose.*

Herpestes vitticollis, *Bennett, P. Z. S.* 1835, p. 67; *Kelaart, Prod.* p. 42; *Jerdon, Mam* p. 137; *Anderson, An. Zool. Res.* p. 188, pl. ix, figs. 3, 4 (skull).

Mangusta vitticollis, *Elliot, Mad. Jour. L. S.* x, p. 103, with coloured plate.

Loko-mugatea, Cingalese.

This is the largest species found in Asia. Tail, including the long hair at the end, about three quarters the length of the head and body, without the terminal hair about three fifths. The fur long and harsh, that on the tail longest. Sole of the hind foot naked to the heel.

In the skull the bony palate runs far back, considerably more than half the distance between the posterior upper molars and the

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end of the pterygoids, which diverge slightly. Teeth large, the hindmost upper and lower molars broader in proportion than in any other Indian species.

Colour. Varying from grizzled dusky iron-grey to rich unspeckled ferruginous or chestnut-red, the red colour being frequently confined to the hinder part of the body and tail, the head always iron-grey above. A black band down each side of the neck from behind the ear to the shoulder, with a paler or more rufous area above and below the band. Legs and feet unspeckled dark brown or black, and a long black tip to the tail. Fur brown at the base, the longer hairs with alternating rings of pale yellowish grey and black, 3 or 4 of each, the dark rings the longer, or there are one or two rings of each colour near the base of the hairs and all the terminal portion is ferruginous.

Dimensions. Head and body 21 inches; tail without hair at end about 13, with it 15; weight 6 lb. 10 oz. Basal length of skull 3·7 inches, zygomatic breadth 2·2.

Distribution. The hills near the west coast of India, from near Bombay to Cape Comorin, and Ceylon. Ceylon specimens appear more rufous than Indian.

Habits. But little known. Jerdon remarks that from its size, this species must be very destructive to game and the smaller quadrupeds. It is often seen on the Nilgiris, and appears abroad at all hours in the day, according to McMaster, who once observed a pair evidently hunting on scent, which they followed to earth, and they then began to burrow. Suddenly they started off at full pace in pursuit of something, probably, McMaster suggests, a hare, which had bolted from another opening of the burrow.

65. **Herpestes urva.** *The crab-eating Mungoose.*

Gulo urva, *Hodgson, J. A. S. B.* v, p. 238 (1836).
Urva cancrivora, *Hodgs. J. A. S. B.* vi, pp. 561, 564; *Jerdon, Mam.* p. 138.
Mesobema cancrivora, *Hodgs. J. A. S. B.* x, p. 910; *Calc. Journ. N. H.* ii. p. 214.
Herpestes urva, *Anderson, An. Zool. Res.* p. 189, pl. ix, figs. 5, 6, skull.
Arva, Nepalese.

Size large, approaching that of *H. vitticollis*. Form more robust than in most species of the genus. Tail about two thirds the length of the head and body. Fur of body and tail very long, coarse and ragged, underfur woolly. Naked sole of hind foot only extending about two thirds the distance to the heel. Mammæ 6, ventral. Two anal glands, one on each side, with external orifices.

In the skull the orbit is probably complete in old specimens. The termination of the bony palate above the posterior nares is concave.

Colour. Dusky iron-grey, or blackish with a greyish surface caused by the long whitish tips to the hairs. A well-marked narrow white stripe runs along each side of the neck from the angle of the mouth to the shoulder. Head dark brown, speckled with white; legs and feet the same, but without any white, the feet often black. The woolly underfur dark brown at the base, then pale brownish yellow, the longer hairs brown close to the skin, then light brown or yellowish brown like the underfur for a considerable length, next black, also for a long distance, and whitish at the tips.

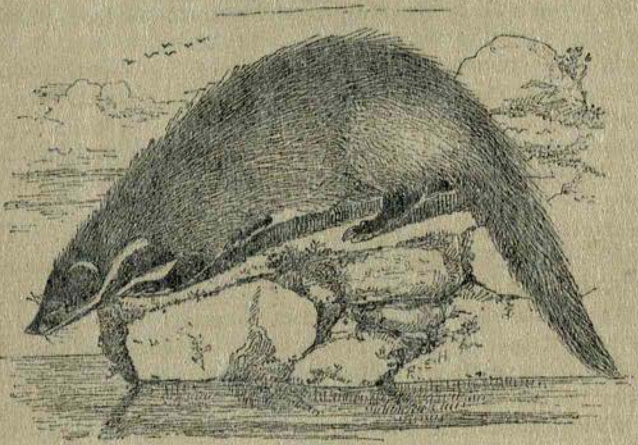

Fig. 35.—*Herpestes urva.*

Dimensions. Head and body 18 to 21 inches; tail without the hair at the end 11 to 12; weight (of a small specimen apparently) 4 pounds. A skull measures 3·3 inches in basal length and 2 in zygomatic breadth.

Distribution. The south-eastern Himalayas at low elevations, Assam, Arakan, Pegu, Tenasserim, and Southern China.

Habits. The heavy form of this mungoose is probably connected with somewhat different habits from those of the typical species, such as *H. mungo.* According to Hodgson *H. urva* is somewhat aquatic, and lives chiefly on frogs and crabs, which abound in the Himalayan and Burmese streams. Like other species, it lives in holes in the ground.

The anal glands are about the size of a cherry, and the animal has the power of squirting out a fœtid fluid from them backwards with great force. A description of these glands has been given by Dr. Campbell (J. A. S. B. vi, p. 565).

Two more species of the genus, *H. javanicus* and *H. brachyurus*, both of large size, are found in the Malay Peninsula and in some of the islands; whilst a third form, *H. semitorquatus*, is peculiar to Borneo. Some other Malay species have been described, but appear doubtfully distinct.

Family HYÆNIDÆ.

The last family of the *Æluroidea* that is found in the Indian area is represented by a single species, the common striped hyæna. But two other species exist, both African. All resemble dogs more than cats, but are more nearly related to the *Viverridæ*, and especially to the Herpestine subfamily, than to either *Felidæ* or *Canidæ*.

The head in hyænas is large and slightly elongated, the tail moderate, limbs rather long; the hallux and pollex are wanting, the tarsus and metatarsus entirely hairy. The feet have a median or plantar pad and one to each digit. The animal is truly digitigrade. The claws are but slightly curved, strong, blunt, and non-retractile.

The skull is remarkable for the great development of the sagittal crest, serving for the attachment of the powerful temporal muscles. The zygomatic arches are very strong. The auditory bulla is inflated but not divided; the paroccipital process distinct; there is neither alisphenoid canal nor pterygoid fossa. The palate extends back but a short distance behind the posterior molars. The teeth are well developed, the upper sectorial being particularly large.

By most naturalists all living hyænas have been classed as one genus, but some writers of late have distinguished the African spotted hyæna as *Crocuta*, on account of its having much smaller upper true molars with but one or two roots, less developed lower true molars, no mane, and some remarkable peculiarities about the female genital organs (Watson, P. Z. S. 1877, p. 369, 1881, p. 516; and Mivart, *ibid.* 1882, p. 198).

Genus **HYÆNA**, Brisson, 1756.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{3-3}$, m. $\frac{1-1}{1-1}$. The outer incisors much larger than the inner, canines and premolars large. Upper sectorial teeth very large, formed of a distinctly trilobed blade and a moderately developed inner tubercle at the anterior extremity of the tooth. Upper molar small and placed transversely close to the hinder edge of the sectorial, as in cats. Lower sectorial consisting of but little more than the bilobed blade. Vertebræ: C. 7, D. 15, L. 5, S. 4, C. 19.

The anatomy of the hyæna has been described by Daubenton in Buffon's 'Histoire Naturelle,' vol. ix, p. 280.

Fossil species are numerous, and no less than five have been recognized in the Siwalik beds of the Punjab, besides one species of an allied genus, called *Lepthyæna* by Lydekker. Remains of the African *H. crocuta* have been found in caves near Karnul, Madras.

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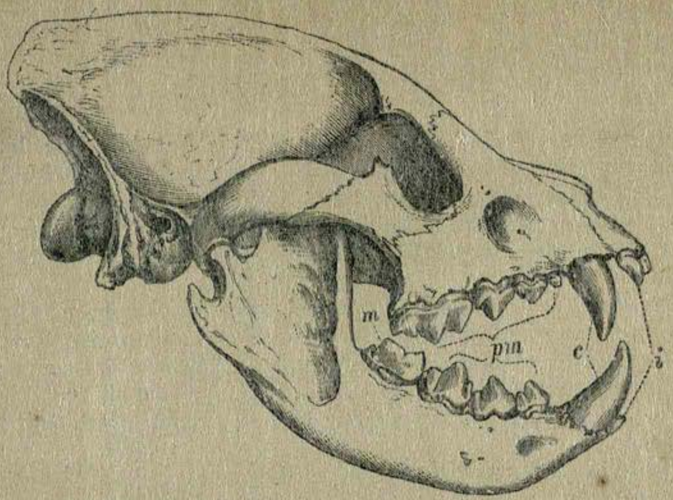

Fig. 36.—Skull of *Hyæna striata*. (Guide to the Galleries of Mammalia, British Museum.)

66. **Hyæna striata.** *The striped Hyæna.*

Hyæna striata, *Zimm. Geog. Gesch.* ii, p. 256 (1780); *Blyth, Cat.* p. 44; *Jerdon, Mam.* p. 118.

Lakar bagha, Lakar bágh or *Lakra, Jhirak, Hondar, Harvágh, Taras,* H. in various districts; *Taras* also Mahr. and Sindhi; *Cherak,* Sindhi; *Aptar,* Baluchi; *Renhra,* Gond; *Hebar kula,* Ho Kol; *Derko Tud,* Paharia of Rajmehal; *Dhopre,* Korku; *Kirba* and *Kut-kirba,* Can.; *Dúmul gúndu, Korna gúndu,* Tel.; *kaluthai-korachi,* Tam.

Tail about three sevenths the length of the body, and clothed with long hair. Hair of the median line on the neck and back long, forming a crest or mane. The hind legs considerably bent and shorter than the fore, the hind feet much smaller than the fore feet. A large post-anal glandular pouch receiving the secretions of the large anal scent-glands.

The upper true molar with three roots; lower true molar with an inner tubercle and a well-developed talon or heel.

Colour. Dirty grey, with narrow transverse tawny or blackish stripes on the body and legs.

Dimensions. Head and body 3½ feet, tail with hair 1½. Skull 8·5 inches in basal length, 6·4 broad across zygomatic arches. Weight of an adult 74 lbs.

Distribution. Throughout the Peninsula of India, rare in forests, abundant in hilly open country. It is very common throughout Central and North-western India, and extends through South-western Asia to Northern Africa. It has not been recorded from Ceylon or east of the Bay of Bengal, and is rare in Lower Bengal.

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Habits. The hyæna is most common in the drier parts of India, and its chief haunts are rocky hills and deep ravines. I have on several occasions turned hyænas out of grass or bushes, and Jerdon notices having met with some in sugar-cane fields; but as a rule this animal remains in the daytime in caves amongst rocks, or in holes, dug by itself, in the sides of hills or of ravines.

It is a nocturnal animal, and although an occasional individual may be met with returning to its den in the early morning, its rambles are usually commenced after sunset and ended before sunrise. During the night it roams far and wide, and no tracks of wild animals are more common, in the countries where it is found, than its unmistakable footprints, very like a dog's in shape, but with the marks of the hind feet conspicuously smaller than those of the fore feet. Unlike the spotted hyæna, the striped species appears to be solitary in its habits, and it is rare to meet with more than two together.

The principal food of the hyæna consists of the carcases of animals that have died of disease or been killed by beasts of prey, and very often it carries off portions of the body to its den. I once shot one that was carrying away the hind leg of a nilgai. The powerful jaws and large teeth are admirably adapted for crushing bones, which are consumed by hyænas, after the flesh has been picked off by vultures and jackals. Occasionally sheep or goats, and more often dogs, are carried off by hyænas, and the latter at all events are often taken alive to the animal's den. Jerdon relates an instance in which a small dog belonging to an officer at Dumoh was carried away, but procured alive the next day from a cave by some sepoys, who killed the hyæna. Fragments of bones are often found around a hyæna's retreat, together with the peculiar dung of the animal, which dries into hard white balls, known as *alba græca*, chiefly composed of fragments of bone, and so indestructible that they have been found fossilized in caves that had been tenanted by extinct forms of these animals.

The hyæna is universally despised for its cowardice; despite its powerful teeth, it rarely attemps to defend itself. It is occasionally ridden down and speared, but unless the ground is peculiarly favourable for horses, it will give a good run before being killed, not on account of its speed, for it is easily caught by a good horse, but from the way it turns and doubles. As a rule, it shows no fight when brought to bay. McMaster, in his excellent Notes, relates an instance in which a hyæna, after being slightly wounded by a spear, was pursued by a game old Arab horse who had lost his rider, and who attempted to seize the hyæna with his teeth and to strike him with his fore foot, an attack that the hunted animal only acknowledged by tucking its tail tightly between its legs.

The cry of the striped hyæna is much less frequently heard than that of the spotted species in the countries inhabited by each respectively, nor are their calls the same, though there is some similarity between them, and both are peculiarly loud and disagreeable.

Hyænas are easily tamed if captured young, and become very docile and greatly attached to their masters.

The number of young in a litter is, I believe, 3 or 4, but about all points connected with the breeding more information is required. The period of gestation does not appear to have been observed.

CYNOIDEA.

Family CANIDÆ.

The *Cynoidea*, consisting of a single family, *Canidæ*, in which are included dogs, wolves, jackals, and foxes, form a group of Carnivores as easily recognized and as distinct as the *Felidæ*.

The head throughout the family is elongate, tail moderate, limbs fairly developed, and the feet truly digitigrade, with the pads similar in number and form to those in cats and hyænas. The print of a canine foot is very similar in shape to that of a hyæna's, both differs from a cat's in having the two middle toe-pads at a greater distance in advance of the other two, and in the whole foot being much longer in proportion to its breadth. Throughout the *Canidæ* there are four toes on the hind foot, except in some cases of domestic dogs, which have five, and all, except the African genus *Lycaon*, have five toes on the fore feet, the pollex being much shorter than the other digits and not reaching the ground. The claws are blunt, nearly straight, and non-retractile.

In the skull the muzzle is much lengthened, the postorbital processes are short, the auditory bullæ inflated but not divided into two by septa; a parocсipital process is attached to the hinder part of each bulla, but projects behind. There is an alisphenoid canal, but only a rudimentary pterygoid fossa.

There are always four premolars on each side of each jaw. The upper sectorial consists of a stout blade, of which the anterior cusp is large, conical, and pointed backwards; the posterior cusp is in the form of a compressed ridge; the inner lobe is very small and placed quite at the fore part of the tooth. The first upper molar is large, and much broader than long, its outer border bicuspid; the second molar is of the same shape but smaller. The lower sectorial is a very large tooth, with a strong compressed bilobed blade, the hinder lobe the larger and more pointed, a small but distinct inner tubercle inside the posterior lobe of the blade, and a broad low tuberculated heel. The second lower molar is less than half the size of the first or sectorial; the third lower molar, when present, is quite small.

Clavicles exist but are rudimentary. The vertebral formula is C. 7, D. 13, L. 7, S. 3, C. 17–22.

The family has an almost world-wide distribution, and all the forms are so closely similar in all essential structural characters

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that generic distinctions are founded on characters of less structural importance than in most families of Mammalia. For an account of the cranial and dental characters see Huxley, P. Z. S. 1880, p. 238.

The *Canidæ* are mostly carnivorous. Many are predatory, and several hunt in troops. Some feed on carrion, on insects, or, in part, on fruit. All have a very acute sense of smell, and both sight and hearing are highly developed.

Three Indian genera are recognized, and may be thus distinguished:

A. A frontal sinus present; postorbital process smooth and convex above; tail, including hair at end (in all Indian forms), less than half the length of the head and body.
  a. Seven teeth in lower molar series .... CANIS.
  b. Six teeth in lower molar series .... CYON.
B. No frontal sinus, postorbital process concave above; tail more than half the length of the head and body .... VULPES.

Many fossil Canines are known. In the Siwalik beds of the Punjab a wolf, *Canis cautleyi*, and a fox, *Vulpes curvipalatus*, have been found, and also a species of the extinct genus *Amphicyon*, which was in some respects intermediate between dogs and bears.

Genus **CANIS**, Linn. (1766).

Syn. *Lupus, Saccalius, Oxygous,* Ham. Smith.

In this genus are comprised the wild wolves and jackals and domestic dogs, the latter being apparently the descendants of several different wild forms, amongst which the common wolf and the common jackal are two of the principal.

The dentition is i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{2-2}{3-3}$. The teeth are powerful. The tail in all wild species forms a moderate brush, the hair being longer than on the body. The pupil is round. There are generally 10, more rarely 8, mammæ.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Head and body about 3 feet 6 inches long; much woolly underfur .... *C. lupus*, p. 135.
B. Head and body about 3 feet long; little or no woolly underfur .... *C. pallipes*, p. 137.
C. Head and body 2 feet to 2 feet 6 inches long .... *C. aureus*, p. 140.

67. **Canis lupus.** *The Wolf.*

Canis lupus, *L. Syst. Nat.* ed. xii, i, p. 58 (1766); *Hutton, J. A. S. B.* xiv, p. 345; *Scully, P. Z. S.* 1881, p. 201.
Lupus laniger, *Hodgs. Calc. Journ. N. H.* vii, p. 474; *Horsfield, A. M. N. H.* ser. 2, xvi, p. 107 (1855); *Blyth, J. A. S. B.* xvi, pt. 2, p. 1176.
Canis chanco, *Gray, P. Z. S.* 1863, p. 94.
Canis niger, *Sclater, P. Z. S.* 1874, p. 654, pl. lxxviii.

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Gúrg, Persian; *Gúrk*, Baluch.; *Kharmá*, Brahni; *Rátnahún*, Kashmir; *Chángú*, Tibetan.

Size large. Tail with hair considerably less than half the length of the head and body, without hair about one third. Fur long and thick, with woolly underfur.

Colour. On the upper parts and the outside of the limbs rufous or yellowish grey, much mixed with black in some skins, lower parts whitish. Underfur on back pale slaty or light brown with coarse whitish hairs intermixed, longer hairs light brown tipped with black; sometimes beyond the black there is a white termination. The tail is often tipped with black. Some individuals are much paler than others, some are quite black.

Dimensions. Head and body 3 feet 6 inches to 3 feet 9 inches, tail without hair 15 to 16 inches, with hair 18 or 19, hind foot from heel 9, ear outside 4·5; height 2 feet 4 inches. A large skull measures 8·7 inches long in basal length, 5·5 broad across the zygomatic arches; a smaller but fully adult skull is 8 inches long, 4·8 broad.

Distribution. Throughout the Palæarctic region, extending into Baluchistan, and Western Sind (where a specimen has been obtained by Mr. J Murray), and probably into the Northern Punjab, as a skull from the Salt Range, collected by Mr. Theobald and now in the British Museum, appears to belong to this and not to the next species. The common wolf, if, as I believe, *C. laniger* is identical, inhabits all countries north of the Himalayan range.

Varieties. The Sind, Baluchistan, and Gilgit animals appear undistinguishable from European wolves. The variety found in Tibet and Ladák is, however, very pale-coloured, with woolly fur, and has generally been distinguished as *C. laniger*. I thought at one time that the dentition was different, the upper sectorial in *C. laniger* being generally shorter than the two upper true molars taken together, whilst the reverse was believed to be the case in *C. lupus* (P. A. S. B. 1877, p. 116); but Huxley in his paper already quoted (p. 279) has shown that the teeth of both European and Tibetan wolves vary in this respect, and the difference in the fur appears due to climate. The cranial distinctions mentioned by Blyth (J. A. S. B. xxiii, p. 733) are probably caused by age. The black Tibetan wolf, classed apart by some, is evidently a variety similar to the black European wolf that was called *Canis lycaon* by Schreber.

Habits. The common wolf plays as large a part in story and myth amongst European nations as the tiger does in India. The wolf's habits are well known, though, as in the case of the great feline beasts of prey, the terror inspired by him has invested him, in popular lore, with many imaginary attributes.

Wolves are found both in open country and forests. As a rule they occur solitary or in pairs, but at times, and especially in the winter, they associate in packs, sometimes of large numbers. They live upon any mammals or birds that they can kill; they carry off

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children, sheep, and goats, and when pressed by hunger attack men. Horses and cattle are only killed when several wolves combine. Carrion is readily eaten by these animals, and in case of need they are said to feed upon vegetable substances, such as buds of trees, lichens, and moss.

Although wolves prey to a considerable extent by night, they are by no means exclusively nocturnal in their habits. Their principal cry is a loud howl, which serves as a call.

The pairing-time is from December to April, the period of gestation 63 days, so that the young, varying in number from four to nine, are born in the spring or early summer. Wolves breed in thickets or in holes in the ground. The whelps are not full-grown and capable of propagating until the third year after their birth. The duration of life is from 12 to 15 years. Young wolves are easily tamed.

68. **Canis pallipes.** *The Indian Wolf.*

Canis pallipes, *Sykes, P. Z. S.* 1831, p. 101; *Blyth, Cat.* p. 39; *Jerdon, Mam.* p. 139.

Canis lupus, *Elliot, Madr. Journ. L. S.* x, p. 101; *Blyth, J. A. S. B.* xi, p. 596.

Bheriya, Gúrg, Hondár, Nekra, Bighána, H.; *Bagyár,* Sindhi; *Lándyá,* Gond and Dakhini; *Tola,* Can.; *Toralú,* Tel.

Structure generally similar to that of *C. lupus*, but the animal is smaller and slighter, and the fur shorter, with little or no woolly underfur. Mammæ 10.

Colour. Greyish fulvous, usually with a brownish tinge, sometimes much mixed with black on the back; some have a reddish tinge, and occasionally it is said that a thoroughly rufous individual is met with. All I have seen are, however, browner than *C. lupus* generally is, and of an earthy grey colour. Hair of varying shades of light brown from the base to near the end; tips black on the back. Coarse white hairs are mixed with the finer fur near the skin. The hairs on the tail have generally black tips. Lower parts dingy white. The young are sooty brown, with a milk-white chest-spot, which disappears about the sixth week from birth, when a dark collar appears below the neck, but is lost at maturity.

Dimensions. Head and body about 3 feet, tail with hair 16 to 17 inches. Skull of an adult male from Sámbhar 6·85 inches in basal length, 4·4 broad. Weight of a female 42 lbs.

Distribution. The Indian Peninsula south of the Himalayas, especially in open plain country; rare in wooded districts and amongst hills. I have never heard of this species occurring on the Malabar coast. Rare in Lower Bengal. Unknown further east: not found in the Himalaya, and apparently replaced by *C. lupus* beyond the Indus, though occasionally seen west of the river. No wolf has been recorded from Ceylon.

Habits. Very similar to those of *C. lupus*, except that the Indian wolf, although somewhat gregarious, is not known to associate in large packs (I have never heard of more than six to eight together). It is also rather a silent animal, but sometimes, Jerdon says, it barks like a pariah dog. It is rarely, if ever, heard to howl.

Indian wolves prey on all mammals or birds they can kill, but especially on sheep, goats, and antelopes. Instances are not rare of their attacking man, two or more combining for the purpose; and they, in some parts of India, carry away a large number of children yearly, usually taking them from villages. They course and run down hares and foxes, and occasionally attack cattle. They not unfrequently kill dogs.

Like all wild canines, these animals are very intelligent and cunning, and many of the stories told of the stratagems they employ to secure their prey appear to be well authenticated. One plan, vouched for by several observers, is that of part of the pack driving antelopes or gazelles across a spot where others of the pack are lying in ambush, either in ravines or in hollows scratched by themselves in the ground. Some wolves, too, are said to lie in wait hidden until antelopes approach them while feeding. A remarkable story is related by a writer in the 'Asian,' who states that he saw a wolf rolling on its back with its legs in the air, whilst some antelopes that were attracted to approach by curiosity advanced to within sixty or seventy yards; then they were accidentally disturbed, and two other wolves, that had been lying in ambush 100 yards apart in advance of the third, jumped up. It is also said that when wolves attack sheep, part of the pack attack and keep the dogs in check, whilst others carry off the prey.

A somewhat similar story is related by Forsyth, except that the victims were children. In the Dumoh district of the Central Provinces an old she-wolf and a full-grown cub haunted a patch of bushes and grass near a village standing on the slope of a hill, down which ran the main street, where children were always at play. The smaller wolf hid amongst bushes between the village and the bottom of the hill, whilst the larger animal went round to the top, and, watching its opportunity, ran down the street, carrying off a child on the way. At first the people used to pursue, and sometimes made the marauder drop his prey; but in that case the companion wolf usually succeeded in carrying off another of the children in the confusion, whilst the child first seized was generally so injured as to be beyond recovery. In this, as in many other similar cases, a very wide-spread superstition prevented the villagers from hunting down and killing the animals; and Forsyth actually found it difficult to get men to assist him in shooting the brutes, in which he fortunately succeeded.

The story illustrates both the cunning and the boldness of the Indian wolf. I myself saw one run out of a village in the middle of the day with a young goat and escape with it in spite of the villagers' pursuit.

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The great aversion to killing a wolf that exists in many parts of India is due, I am told by Mr. Theobald, to a widely spread belief that the blood of a wolf, if shed upon the lands of a village, renders them unfruitful.

The Indian wolf has both speed and endurance, and has very rarely, if ever, been run down and speared from horseback, though the feat has often been attempted. McMaster, after briefly describing an unsuccessful attempt, very appropriately quotes *Byron's* lines in 'Mazeppa' about wolves:—

> "With their long gallop, which can tire
> The hound's deep hate and hunter's fire."

If hunted with greyhounds a wolf generally, after going for some distance, turns upon the dogs and chases them back to the huntsman. Instances of this are given by both Jerdon and Forsyth; but the latter relates how in one case a wolf that had chased back two greyhounds met his match in a bull mastiff. Jerdon states that a wolf once joined his greyhounds in hunting a fox.

In the Indian desert between Rájputána and Sind wolves are said by Sir B. Frere (Journ. R. Geogr. Soc. 1870, p. 204) to be dug or smoked out of their dens amongst the sand-hills. This is generally done about midday in the hottest part of the hot season; the men engaged protect their feet with folds of raw hide, and if the wolves are not clubbed or speared at once they are easily run down, as the hot sand blisters their feet and disables them.

I was told by Mr. Le Mesurier, formerly chief engineer of the Great Indian Peninsular Railway, that he succeeded in capturing many wolves in a pitfall consisting of a circular trench with perpendicular sides, and too deep for the animal to jump out of. On the ground left at the original level in the middle of the circular trench, a goat was tethered, and the trench was thinly covered with sticks and straw, that gave under the wolf's weight.

Indian wolves breed in holes or in caves among rocks. Dr. Bonavia, in a letter published in 'Nature' for 1875 (vol. xii, p. 67), states that the young vary in number from three to eight, and are born from October to December, chiefly in the latter month. He adds that they are born blind and with drooping ears. The young are easily tamed, and they have all the habits of dogs *; indeed, the common Indian dogs may be in part descended from wolves, although they are probably chiefly derived from jackals. There is some evidence to show that the Indian wolf occasionally breeds with the village dogs; whilst Sir B. Frere (Journ. R. Geogr. Soc. 1870, p. 205) mentions that in the Indian desert a pariah bitch was known to associate with a pack of wolves.

Stories about wolf-reared children are common in Northern India, especially in Oudh. Particulars of several supposed cases

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* A curious instance may be mentioned. Dr. J. Anderson gave two young tame wolves a teal that was rather high. They would not eat it, but rolled over on it exactly as many dogs would do.

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were collected by Colonel Sleeman, and several are recorded by Sir R. Murchison (A. M. N. H. 2, viii, p. 153) and Mr. Ball (P. A. S. B. 1873, p. 128, and 'Jungle Life,' pp. 455–466). It is doubtful how far any are authentic. All the children were boys, and all appear to have been idiots.

69. **Canis aureus.** *The Jackal.*

Canis aureus, *Linn. Syst. Nat.* i, p. 59 (1766); *Elliot, Madr. Journ. L. S.* x, p. 131; *Blyth, Cat.* p. 40; *Jerdon, Mam.* p. 142.
Canis aureus indicus, *Hodgson, As. Res.* xviii, p. 237.
Sacalius indicus *and* Oxygous indicus, *Hodgs. J. A. S. B.* x, p. 908.

Gidár, Siyál, or *Shiál, Phiál,* H.; *Laraiya,* Bandelkand; *Shigal,* Pers.; *Srigala,* Sansc.; *Shál* ♂, *Sháaj* ♀, Kashmiri; *Tolágh,* Baluchi; *Kolá,* Mahr. and Dakh.; *Karincha,* Ho Kol; *Kolial, Nerka,* Gond.; *Nari,* Can.; *Kalla-Nari,* Tam.; *Nakka,* Tel.; *Karaken, Nari,* Mal.; *Naria,* Cing.; *Amu,* Bhot.; *Hiyál,* Assamese; *Meshrong,* Kachari; *Hijai, Joksat,* Mikir; *Hian,* Naga; *Mye-khwe,* Burm.

Tail with the hair at the end about one third the length of the head and body. As a rule, the upper sectorial is much shorter than the two true upper molars taken together; but in two out of twelve measurements given by Huxley the length is the same. Mammæ 10.

Colour. Pale isabelline to pale rufous, more or less mixed with black on the upper parts; muzzle, ears, and outside of limbs more rufous; lower parts paler, sometimes nearly white; hair of the fore neck with dusky tips. The underfur on the back is brown, paler at the base, the longer hairs on the back beyond the underfur grey with black tips. The tail-hairs are reddish brown, with long black terminations, making a black tail-tip. Bright rufous, coal-black, and pure white albino individuals have also been recorded (Blyth, J. A. S. B. xxvii, p. 275).

Dimensions. Variable, some animals being much larger than others. The head and body certainly vary from 2 feet to 2 feet 6 inches in length, and I have seen measurements given of 2 feet 8 inches, though these must, I think, have been taken on skins. A large male from the Nipalese Terai measured: head and body 30 inches, tail without hair at the end 9, with hair 11, ear 3·2; weight 20 lbs. A small female from Rájputána measured: head and body 24·6, tail without hair 9, with hair 12·1, ear 3·2, hind foot from heel 5·5. Skulls are also very variable (see Huxley, P. Z. S. 1880, p. 277); a large one measures 5·8 inches in basal length and 3·5 in zygomatic breadth, an adult female 4·95 by 2·9.

Distribution. The jackal is found throughout the whole of India and Ceylon, on hills and plains, in forest and open country, and even in populous cities. It ascends the Himalayas to an elevation of 3000 or 4000 feet, and is occasionally found higher, especially around hill-stations, whilst it is common on the Nilgiris in Southern India. It is more rare east of the Bay of Bengal, but is

GSL

found in Assam and Cachar, and is not uncommon at Akyab and about Thayet Myo in Northern Pegu. It has also recently been observed close to Mandalay. The only place where I have heard of its occurrence farther south or east is near Moulmain *, where Mr. Theobald tells me he once saw two; but it is possible these might have been introduced. West of India it extends throughout South-western Asia to the Caucasus, and is found in South-eastern Europe in Greece and Turkey, and as far west as Dalmatia, also throughout Northern Africa, being replaced by closely allied species in the Ethiopian region.

Habits. Jackals are found singly or two or more together, and they sometimes associate in considerable numbers, especially at night, as is shown by their howlings. They are principally nocturnal, more so, I think, than the Indian wolf, but by no means exclusively; in the cold season they may be seen about at all hours. Their food is very varied, consisting of carrion of all kinds, any beasts or birds that they can master, and, in default of animal food, fruit. The jackal is one of the common scavengers of towns and villages, feeding on offal or dead carcases of any kind, and occasionally killing poultry or even lambs or kids. "Sickly sheep and goats usually fall a prey to him, and a wounded antelope is pretty certain to be tracked and hunted to death by jackals" (*Jerdon*). Amongst fruits, he especially feeds on *ber* (*Zizyphus*), and he is said in several parts of India to be very fond of sugar-cane and of maize. "In Wynaad, as well as in Ceylon, he devours considerable quantities of ripe coffee-berries; the seeds pass through him, well pulped, and are found and picked up by the coolies; it is asserted that the seeds so found make the best coffee!" (*Jerdon*). As Sterndale explains, these seeds are the best because the jackals select the finest fruit.

The cry of the jackal is familiar to all who have ever resided in the countries inhabited by the animal, and consists of two parts—a long wailing howl three or four times repeated, each repetition in a note a little higher than the preceding, and then a succession of usually three quick yelps, also repeated two or three times. The common Anglo-Indian version of "Dead Hindoo; where, where, where," gives some idea of the call. In one African jackal, *C. variegatus* of Abyssinia, the second portion of the cry is entirely wanting.

There is, however, another, a very peculiar call, only uttered by the jackal, it is believed, when a tiger or leopard is in the neighbourhood, and certainly uttered upon such occasions. The cry is unmistakable, I have several times heard it; but the jackal that makes it carries us at once into the region of fable and folk-lore. The same story that has existed on the shores of the Mediterranean for two thousand years at least, that a jackal acts as scout for the lion, or "lion's provider," and is repaid by a share of the prey, is commonly believed with regard to the tiger in India; and it is this peculiar jackal, known as *Pheál*, or *Phiou*, or *Phnew* (see Torrens, J. A. S. B. xviii, p. 788) in Northern India, the name being taken from the cry, and as *Bhálú* or *Kol bhálú* in Southern and Western India, that is said to invariably precede the tiger and to make the call just noticed. Several observers have, however, remarked that the jackal which makes the cry follows the tiger and does not precede him; and Mr. Blyth has observed that a pariah dog, on sniffing a collection of caged tigers in Calcutta, set up a most extraordinary howl, probably similar to that of the *Pheál*. Jerdon gives an excellent abstract of the opinions expressed by various writers, and concludes, as others have done, that the cry is an alarm-note. This appears probable; tigers, if they have an opportunity and are hungry, may kill and eat jackals, and leopards certainly do so.

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* There are, however, in the Leyden Museum two stuffed specimens of this animal collected by Diard, and one of them is labelled from Malacca, the others from Borneo. It is impossible to say whether the localities are correct.

Another belief, which appears widely diffused in India and Ceylon, is that a horn grows on the head of some jackals, and is of great virtue to its possessor.

The jackal is occasionally hunted by hounds, and gives a good run, but is quickly caught by greyhounds, who, however, cannot always dispose of him easily. He is, Jerdon says, very tenacious of life, and shams dead in a way to deceive even experienced sportsmen.

The period of gestation in the jackal is usually said to be sixty-three days, the same as in the wolf and dog; but, as might be expected, there is some variation, and there appears good reason for believing that the time in the jackal is a few days less * on an average. The number of young in a litter is about four; the female brings forth in holes in the ground, occasionally (as Jerdon remarks) in dry drains. That some breeds of domestic dogs, perhaps all the smaller races, are derived from jackals appears to be the opinion of most competent naturalists. The two breed together freely, and it is probable that some of the jackal-like dogs seen about Indian villages may be hybrids.

Jackals are liable to attacks of rabies, and mad animals are not uncommon, many cases of hydrophobia having resulted from their bites both in men and animals.

Genus **CYON**, Hodgson (1838).

Syn. *Cuon*, Hodgson; *Chrysæus*, Ham. Smith.

There are only two true molars on each side of the lower jaw, instead of three, as in *Canis*, the dentition being:—i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$,

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* The subject is fully discussed by Darwin ('Animals and Plants under Domestication,' i, p. 29). The question of the origin of domestic dogs is there treated at length.

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pm. $\frac{4-4}{4-4}$, m. $\frac{2-2}{2-2}$. The muzzle is proportionally shorter, and the line of the face, when viewed from the side, is slightly convex, instead of being straight or concave as in other *Canidæ*.

The mammæ are more numerous, being 12 or 14 instead of 10. There is long hair between the foot-pads.

In all other respects the genus *Cyon* agrees with *Canis*. *Cyon* has a very peculiar geographical distribution, being found in Central Asia as far north as the Altai, the Amurland, and Sagalien, and throughout the Oriental region, but not, so far as is known, in Northern China or Japan.

There is some doubt about the specific characters, but two distinguishable forms appear to inhabit our area *.

Synopsis of Indian and Burmese Species.

A. Larger and stouter; hair long, with woolly underfur, ferruginous red to tawny. Skull 6·75 to 7 inches long; tarsus and hind foot over 7 inches	*C. dukhunensis*, p. 143.
B. Smaller and slighter; hair short, no underfur, brighter ferruginous. Skull 6·25 inches long, tarsus 6	*C. rutilans*, p. 147.

The term "wild dog" applied to these animals is clearly a misnomer, for in every important detail in which the genus *Cyon* differs from *Canis* (wolves and jackals)—in the form of the skull, the dentition, and the number of mammæ—domestic dogs agree with the latter and not with the former. The name has doubtless been applied to the present genus on account of its hunting in packs, like hounds, its fine handsome and bold appearance, and its courage.

A description of the anatomy of this genus is given by Dr. Murie (P. Z. S. 1872, p. 715). The anal glands have been described by Hodgson (Calc. Journ. N. H. ii, p. 412), and the skeleton by Dr. Campbell (*ibid.* p. 209). The strong and unpleasant odour of the animal, which resembles that of the jackal, appears due, in part, to the secretion from these glands.

70. **Cyon dukhunensis.** *The Indian wild Dog.*

Canis dukhunensis, *Sykes, P. Z. S.* 1831, p. 100, 1832, p. 15; *Blyth, J. A. S. B.* xi, p. 591.

Canis primævus, *Hodgson, As. Res.* xviii, pt. 2, p. 221 (1833), with figure.

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* These were united by Blyth, Jerdon, Murie (P. Z. S. 1872, p. 720), and others, and I am by no means confident that the distinctions here pointed out are sufficiently constant to justify separation, but they are found in all the specimens I have been able to examine—seven or eight of *C. dukhunensis* or *primævus*, and four of *C. rutilans*.

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Cuon primævus, *Hodgs. A. M. N. H.* i, p. 152 (1838); *Calc. Journ. N. H.* ii, pp. 208, 412; *Adams, P. Z. S.* 1858, p. 514.
? Cuon grayiformis, *Hodgs. Cat. Mam. &c. Nepal & Tibet B. M.* 2nd ed. p. 5 (1863).
Cuon rutilans, *Blyth, Cat.* p. 37; *Jerdon, Mam.* p. 145 (*nec Müller*).

Son-kutta, *Rám-kutta*, *Jangli*, or *Ban-kutta*, H.; *Kolsun*, *Kolasna*, *Kolasra*, *Kolsa*, Mahr.; *Eram-naiko*, Gond.; *Tani*, Ho Kol; *Vatai-karau*, Tam.; *Reza-Kútá*, *Adavi-Kútá*, Tel.; *Shin-nai*, Mal.; *Rám-hun*, Kashmir; *Siddaki*, Ladák; *Bhaosa*, *Bhúnsa*, *Buánsú*, in the Himalayas from Simla to Nipal; *Hazi*, *Phará*, Tibetan; *Paoho*, Bhot.; *Sa-túm*, Lepcha.

The general form is rather that of the jackal than of the wolf, the legs being shorter than in the latter. Fur long, with thick woolly underfur in Tibetan and Himalayan skins. The tail is a good brush. General form stout. The upper sectorial is decidedly longer than the two upper true molars together.

Colour. On upper parts generally rusty red, varying in some specimens to rufous grey or even light brownish grey, paler below. The colour is generally not uniform, being variegated by dark tips to the dorsal hair. The underfur, when present, varies in colour from light brown to dull rufous on the upper parts, and has light-coloured coarser hairs intermixed; the longer hairs are light rufous, with dark rusty-red tips. Terminal portion of tail black (very rarely the extreme end is whitish). The young animals are sooty brown throughout.

Dimensions. Head and body of a male 37·5 inches, tail without hair 8, with hair 14½, tarsus and hind foot 7⅝; weight 27 lbs. (*Hodgson*). The animal had been in confinement and was very thin. A skull measures 6·5 inches in basal length, 4·2 in zygomatic breadth; length of upper sectorial 0·85.

Distribution. The Indian wild dog is found in Gilgit, Ladák, and other parts of the Upper Indus valley; it was obtained by Hodgson from Eastern Tibet, and it occurs throughout the Himalayan forests from Kashmir to Assam. It also inhabits all the larger forests of the Indian Peninsula, but I cannot find it recorded from Ceylon except by Jerdon, and he was perhaps misled by Hamilton Smith's *Chrysæus ceylanicus*, which appears to have been a domestic or semi-domestic dog. Kelaart distinctly denies the existence in Ceylon of the present animal.

It is doubtful whether the species found in the countries between Assam and Tenasserim is this or the next.

No Indian mammal has so remarkable a range as *C. dukhunensis*. Judging from other mammals, it might have been expected that the Tibetan and Himalayan species, *C. primævus* of Hodgson, would prove identical rather with the Siberian *C. alpinus*, Pallas, than with the Indian *C. dukhunensis*. But Scully has shown (P. Z. S. 1881, p. 202) that *C. alpinus* is distinguished by its much larger upper true molars, whilst no constant difference has hitherto been detected between *C. primævus* and *C. dukhunensis*.

Habits. The wild dog of the Indian Peninsula is a forest animal,

CSL

but in the Upper Indus valley and Tibet must inhabit open hilly country, as there is no forest. It is, as a rule, diurnal, but may move about by night also. It is thoroughly predatory, living, as a rule, on the animals killed by itself and the associated members of the same pack; but probably, like other canines, feeding upon carrion and on vegetable food at times. McMaster, to whom we are indebted for some very good notes on the species, found that an animal kept in confinement ate herbs, grass, and leaves of various kinds greedily, "not as dogs do when ill, but with a keen relish."

All forms of the genus *Cyon* hunt in packs, usually from six to twelve, but sometimes as many as twenty in number, and live principally upon deer of various kinds and wild pigs in India, and on wild sheep and antelopes in Tibet. Many sámbar and spotted deer are killed by them, whilst occasionally nilgai and Indian antelopes fall victims. Wild dogs avoid the neighbourhood of man, and consequently but rarely attack domestic animals; occasionally, however, they kill sheep, goats, and cattle, and Jerdon mentions one instance, and McMaster another, of their pulling down a tame buffalo. I came across a third case myself in the jungles east of Baroda, and I was curious to see how so large an animal had been destroyed. There were but a few tooth-marks about the nose and throat, and some of the pack had evidently attacked the buffalo in front, whilst others tore it open. This is probably their usual way of killing large animals; they have been seen to snap at the flank of a sámbar running.

The statement made by Hodgson, apparently on native information, that wild dogs give tongue when hunting is denied by the excellent observer and sportsman Colonel Hamilton, who wrote under the name of "Hawkeye," and who is quoted by McMaster. I have twice met with these animals in the act of hunting, once on the Nilgiris and a second time east of Raipur in Chhatisgarh, and in neither case did I hear any sound. They are said, however, to howl at night.

Throughout India there is a general belief that these wild dogs hunt and kill tigers. Whilst not absolutely rejecting the tale, I must say that I think it improbable. The wild dog drives away all deer and other wild animals on which tigers feed, and probably the latter follow their prey. At the same time, some of the accounts of wild dogs attacking tigers are singularly circumstantial. Captain Baldwin, in 'The Large and Small Game of Bengal' (p. 19), gives the particulars of one case, apparently as well authenticated as an account can be that rests upon the evidence of villagers inhabiting wild parts of the country. In this case the remains of a tiger that had been devoured were said to have been found together with three dead wild dogs. The same writer (p. 108) describes an instance, said to have been witnessed by an English sportsman, of an attack by wild dogs on the Himalayan black bear (*Ursus torquatus*). Another case in which wild dogs are asserted to have killed a tiger is mentioned by Mr. Sterndale in 'Seonee' and in his 'Natural History of Indian Mammalia.' In other instances the wild dogs are said to have disputed with a tiger or a leopard the possession of prey that had been killed by the latter. It is not improbable that such disputes occur, that they result in the death of some of the wild dogs, and that the remains of the bullock or sámbar over which the contest has occurred are taken by credulous men for tiger's bones.

Another story about the wild dog, also universally believed in India, and quoted by Hodgson and others as if perfectly authentic, is that the urine of these animals is excessively acrid, that they sprinkle with it the bushes through which they drive their prey, and then rush upon the latter when blinded by the pungent fluid. Another version is that they jerk the urine into their victim's eyes with their tails. This is sometimes said to be their method of killing tigers, and in Burmah they are even supposed to destroy elephants by this stratagem. It is scarcely necessary to say that, except Hodgson, none of the naturalists (such as Jerdon, McMaster, and Sterndale) who mention this extraordinary story express any belief in it. A somewhat similar story (I suspect a myth) is told about wolves in Europe, and related by so good an observer as Blasius ('Säugethiere Deutschlands,' p. 182), to the effect that when large animals such as cattle or horses offer much resistance to wolves the latter dip their tails or the whole of their bodies in water, and either shake themselves before the animal they are attacking, or whisk their tails into his eyes and then rush on him in a body whilst his eyes are closed.

Although many large animals are killed by wild dogs, no instance appears to be known of their attacking man.

Wild dogs are said to be absolutely untamable, and, although this is perhaps an exaggeration, they are certainly very difficult to tame. In one instance mentioned by Hodgson there was a certain amount of domestication of a young individual, as it would play with dogs, and allow itself to be caressed by its owner, but others remained for years as fierce and shy as when caught, and this is the experience of all other writers.

The breeding-period is in the winter. The time of gestation is not accurately known, but is probably about two months; the young are produced in holes or caves among rocks from January to March, and there are sometimes six or more in a litter; but, according to Hodgson's observations, usually two to four. A breeding-place was discovered by Mr. Wilson near Simla, where several females apparently bred together.

71. **Cyon rutilans.** *The Malay wild Dog.*

? Canis javanicus, *Desm. Mamm.* p. 198 (1820).
Canis familiaris, *var.* sumatrensis, *Hardwicke, Trans. Linn. Soc.* xiii, p. 235, pl. xxiii (1822).
Canis rutilans, *S. Müll. Verhandelingen, Zool. Zoogd.* pp. 27, 51 (1839); *Blyth, Mam. Birds Burma*, p. 24.
Cuon primævus, *Cantor, J. A. S. B.* xv. p. 196, *nec Hodgson.*

Tau-khwe, Burm.; *Anjing-utan*, Malay.

Smaller and slighter in build than *C. dukhunensis*, limbs much more slender. The length of the upper sectorial is very little more than that of the two upper true molars. No woolly under-fur; hair of body short and harsh; brush smaller than in *C. dukhunensis.*

Colour. Uniform deep ferruginous red above, hair scarcely paler towards the base. Lower parts whitish. Terminal portion of tail black. (The original *C. javanicus* was said to be black on the back and outside of the limbs.)

Dimensions. Head and body 32½ inches in a young male, tail 12; tarsus and hind foot in adults 6 inches. An adult female skull from Moulmein measures 5·9 inches in basal length, 3·5 in zygomatic breadth, length of upper sectorial 0·75.

Distribution. Throughout the Malay Peninsula, Sumatra, Java, and it is said Borneo. This is the species found in the Tenasserim provinces; and there is a specimen from Moulmein in the British Museum. Whether the form that inhabits Northern Burma is identical with this or the last species is not known.

Habits. Similar to those of *C. dukhunensis.*

Genus **VULPES**, Brisson, 1758.

Foxes, although frequently classed in the same genus with wolves and jackals, differ sufficiently to be entitled to generic distinction, being of slighter build with a longer tail, sharper muzzle, proportionally longer body and shorter limbs. The tail is always considerably more than half the length of the head and body, and is covered with long hair. The ears are large, the pupil of the eye vertically elliptical in a strong light, and there are 6 mammæ.

There is no frontal sinus in the skull, and the form of the anterior portion of the brain differs from that of *Canis* *. The upper surface of the postorbital processes is concave. The nasal bones do not extend so far back on the face as the maxillaries.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{2-2}{3-3}$, as in *Canis.*

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* Huxley, P. Z. S. 1880, p. 246.

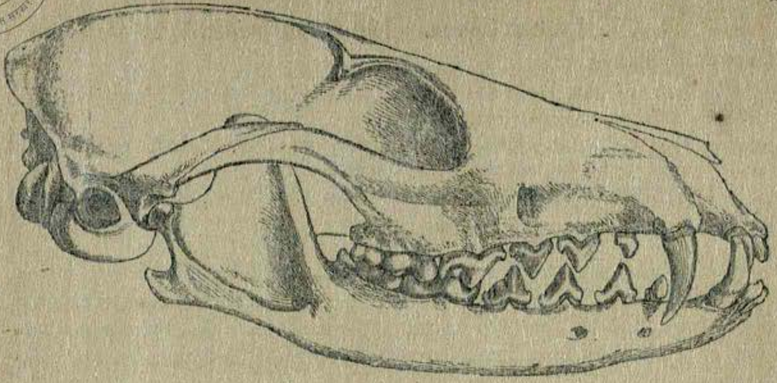

Fig. 37.—Skull of *Vulpes bengalensis*. (Gray, P. Z. S. 1868, p. 517.)

Synopsis of Indian Species.

A. Tip of tail black; ears grey outside.
  a. Rufous grey, small; skull about 4¼ inches long *V. bengalensis*, p. 148.
  b. Ashy grey, very small; skull about 3½ inches long . . . . *V. cana*, p. 150.
B. Tip of tail white.
  a. Ears black or dull brown outside.
    a'. Small; hind foot and tarsus 4 to 5 inches long . . . . *V. leucopus*, p. 151.
    b'. Large; hind foot and tarsus about 6 inches long . . . . *V. alopex*, p. 153.
  b. Ears pale rufous outside; size small . . . . *V. ferrilatus*, p. 155.

Foxes are chiefly nocturnal in their habits, hiding in holes or burrows made by themselves, or in ravines or amongst grass or bushes during the day. They are, as a rule, solitary, and rarely if ever associate in numbers as other *Canidæ* do. All the species are more or less insectivorous and frugivorous; but the more tropical forms appear to live on insects more than those do that inhabit temperate climates. All are highly intelligent and famous for cunning.

72. **Vulpes bengalensis.** *The Indian Fox.*

Canis bengalensis, *Shaw, Gen. Zool.* i, p. 330 (1800); *Elliot, Mad. Journ. L. S.* x, p. 102.
Canis bengalensis (*and* C. rufescens?), *Gray, Hardwicke's Ill. Ind. Zool.* ii, pls. 2 & 3.
Canis kokree, *Sykes, P. Z. S.* 1831, p. 101.
Canis vulpes indicus, *Hodgson, As. Res.* xviii, pt. 2, p. 237 (1833).
Cynalopex bengalensis, *Blyth, Cat.* p. 41.
Vulpes bengalensis, *Horsfield, Cat.* p. 84; *Jerdon, Mam.* p. 149.
Vulpes hodgsonii, *Gray, Charlesworth's M. N. H.* i, p. 578.

Lúmri, Lōm, Lokri, H.; *Lukhariya* in Bundelkand; *Khekar, Khikir*, Behar; *Khek-siyal*, Beng.; *Kokri*, Mahr.; *Khekri*, Gond; *Konka-nakka, Gúnta-nakka, Poti-nara*, Tel.; *Konk, Kemp-nari, Chandak-nari*, Can.

Size small. Limbs very slender. Tail shorter in proportion than in typical foxes.

Colour. Above rufescent grey, varying with the season and locality from almost silver-grey to greyish rufous, minutely speckled with white, the sides very much greyer than the back; lower parts whitish, usually pure white on the chin and throat, pale rufous yellowish or creamy white on the lower breast and abdomen, and more rufescent towards the vent. No cross band on the shoulder. Dorsal fur sometimes white throughout, except at the tip, but when long, in the cold season, white at the extreme base, dusky or purplish slaty, with coarser white hairs intermixed, for about one quarter to one third the length, then creamy white or pale rufous but becoming darker gradually nearly to the end, where there is a white ring followed by a ferruginous or black tip. The fur on the lower parts is whitish throughout. The outer surfaces of the limbs are bright rufous; there is a black spot on each side of the muzzle in front of the eye; the ears are grey outside, whitish within. Tail grey, more or less rufescent above, many of the hairs with black tips, and those at the end of the tail entirely black, forming a sharply defined black tail-tip.

Dimensions. Head and body about 20 inches, tail without the hair at the end 11, with the hair 13 to 14, tarsus and hind foot about 4. A skull is 4·15 inches in basal length, 2·5 broad across the zygomatic arches; a smaller 4 by 2·25. Weight about 7 lbs. (males $7\frac{1}{4}$ to 8, females $5\frac{3}{4}$ to $6\frac{1}{4}$).

Distribution. Found commonly throughout India, except in thick forest, from the base of the Himalayas to Cape Comorin, but not recorded west of Sind and the Punjab, nor east of Assam, where it is rare. Unknown in Burma. Its occurrence in Ceylon is very doubtful; Kelaart mentions a report of its existence in the Badulla district, but evidently without placing any dependence on the story.

Habits. Jerdon's description of this animal's habits is excellent, and is confirmed and supplemented by McMaster's notes. This pretty little fox is familiar to many of the inhabitants of India, being common in most open parts of the country, whether cultivated or waste, and being by no means shy, but frequently coming into gardens and enclosures around houses. I have seen it on the Maidán in Calcutta, and its cry may be heard there almost nightly in the cold season. The sound, a little chattering bark, as Sterndale aptly calls it, consists of a sharp yelp quickly repeated three or four times.

The present species feeds less upon birds and more upon small mammals, reptiles, and insects than its larger allies. It but rarely carries off poultry. According to Sir Walter Elliot, it subsists mainly on rats, land-crabs, grasshoppers, and beetles; but Jerdon has seen it hunting quail, and says that it doubtless kills young birds and eats eggs. He also remarks that lizards are a favourite food with it, that it habitually eats fruit, such as ber (*Zizyphus*), melons, &c., and occasionally pods and shoots of gram or channa

(*Cicer arietinum*) and other vegetables; whilst both he and McMaster have observed it feeding on termites or white ants, especially the winged forms that emerge in flights in the hot season. McMaster relates having once near Hyderabad, in the Deccan, seen a fox spring out of the grass and catch moth after moth as they passed him just before dusk.

The burrows in which the Indian fox lives and breeds are usually situated in open plains, sometimes in thorny scrub, a slight rise in the ground, the bund of a tank or other artificial elevation being selected in places liable to be flooded in the rainy season. There are several openings to each burrow, some of them blind, others leading to a larger central chamber, two or three feet below the surface. Jerdon relates that on two occasions he ran foxes to holes in hollow trees.

The Indian fox does not exhale the strong odour characteristic of the European species, and is said to afford but little scent to dogs. *V. bengalensis* is but rarely hunted with foxhounds, partly on this account, partly because of its numerous earths. It, however, is frequently coursed with greyhounds, and gives a good run with Arab, Persian, or half English dogs, pure-bred English hounds being too fast. It doubles in a most dexterous manner, taking advantage of every accident of the ground, such as a ditch or ravine, and frequently making good its escape to earth or into bushes. McMaster, who writes enthusiastically about this game little animal, says he was once beaten by a tired fox, that escaped the dogs by running amongst a herd of sheep and cattle.

In its movements this animal is quick, active and graceful. Jerdon notices that the tail is carried trailing when the fox is going slowly or hunting for food, horizontal when running, and almost erect when making a sudden turn.

This fox is easily tamed and is said to be an amusing pet, free from smell and cleanly it its habits. It is not often kept tame as it is believed to be liable to attacks of rabies. There is, however, some probability that such cases as have occurred, if not caused by infection, may have been due to too close confinement.

The breeding takes place in burrows. The pairing-time varies according to locality from November to January, and the young, almost always four in number, are produced from February to April. At this season the female is seldom to be met with after sunrise, and the cubs are very rarely seen outside their earth till nearly full-grown.

73. **Vulpes cana.** *The hoary Fox.*

Vulpes canus, *W. Blanford*, *J. A. S. B.* xlvi, pt. 2, p. 321 (1877); *Sclater*, *P. Z. S.* 1878, p. 392.

Poh, Baluch.; *Kúrba-shákál* (cat-jackal), Persian of Kandahár.

Size very small; tail long and bushy; fur long and very soft. Skull (in the only specimen examined) destitute of any sagittal crest. Muzzle short and narrow. The inner lobe of the upper sectorial tooth very small.

Colour. Ashy grey, blackish on the back and sometimes with a rufescent tinge, white below. The basal half of the dorsal fur is dark purplish grey in some skins, the distal half grey or rufescent; in other cases the hairs are light ashy grey almost throughout, the longer and coarser hairs have white rings near the end, and black tips on the back. The long tail-hairs are ashy near the base, white near the ends, the tips black, the black tips being more developed posteriorly so that the tail has a black tip, though less defined than in *V. bengalensis.* Ears grey outside, creamy white on the margin and within; forehead rufous; a dusky or black spot on each side of the muzzle. Outside of the limbs dark rufous or dark ashy, almost black in some cases.

Dimensions. Head and body 18 inches, tail with the hair at the end 15 to 16, without 12½ to 13. In the skull the basal length is 3·35, zygomatic breadth 2.

Distribution. Baluchistan and Southern Afghanistan, possibly extending eastwards to Sind. I have hitherto only been able to examine two skins and a skeleton, the types, procured by Major Mockler at Gwádar, and a skin from Kandahar sent to me by Sir O. B. St. John.

Nothing is known of the habits of this species.

74. **Vulpes leucopus.** *The Indian desert Fox.*

Vulpes flavescens, *Blyth, J. A. S. B.* xxii, p. 581, *nec Gray.*
Vulpes leucopus, *Blyth, J. A. S. B.* xxiii, p. 729 (1854), xxv, p. 443, xxvi, p. 239; *Jerdon, Mam.* p. 151.
Vulpes griffithii, *Blyth, J. A. S. B.* xxiii, p. 730; *id. Cat.* p. 43; *Scully, A. M. N. H.* ser. 5, viii, p. 226.
Vulpes pusillus, *Blyth, J. A. S. B.* xxiii, pp. 729, 730; *Adams, P. Z. S.* 1858, p. 516; *Jerdon, Mam.* p. 153.

Lúmri or *Lokri*, H. and Sindhi; *Lombar*, Baluchi; *Rubah*, P.

Size small, though rather larger than that of *V. bengalensis.* Fur full in winter.

Colour of typical form. In winter the back is more or less rufous, speckled with white, and varies from brownish yellow to rusty red. There is usually a distinct pale patch on each side of the back behind the shoulder, and the cross stripe in front of these patches is well marked. The sides are grey or whitish, more or less speckled, becoming darker, often iron-grey or simply rufous, on the outside of the limbs. The lower parts as a rule are slaty or purplish grey to blackish, abdomen paler, chin and generally a spot in the middle of the breast white. The underfur on the back purplish brown throughout the basal half to three quarters, the extreme base being sometimes whitish, median portion rufous, then white for some distance, and the tip red. On the sides the hairs are white throughout, except a few which have blackish tips. On the underparts the fur is purplish brown, paler towards the base,

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and with more or less developed white tips. The ears are black or dark brown outside except near the base, whitish within and on the edges. Face rufous, especially round the eye; usually a dark spot in front of each eye. The inside of the fore limbs, and especially the whole anterior surface of the hind limbs to the toes whitish or white, hence the name. Tail above the same colour as the back, less rufous on the sides and below, many of the hairs with dusky tips; terminal portion of tail pure white.

In spring, when the hair is worn, the dark underfur is exposed on the back, and the whole animal is greyer. The lower parts are probably white in summer.

Dimensions. Head and body 19 to 22 inches, tail with hair at the end 12 to 16, without 11 to 14, ear outside 3 to 3·5, tarsus and hind foot 4 to 4½. An average-sized female skull is 4·2 inches long (basal length) and 2·4 broad; a large male skull 4·45 by 2·65. Weight about the same as that of *V. bengalensis*, or rather more; the specimen of which Jerdon gives the weight as 5½ lbs. was probably small.

Varieties. I am inclined to class together the three forms distinguished by Blyth because, after seeing a great many specimens of *V. leucopus* from Sind and Rájputána, I am unable to find any characters by which the small Afghan fox, *V. griffithi*, and the Punjab fox, *V. pusilla*, can be distinguished. Both are probably, as a rule, rather larger, but the difference is trifling; and a skull of *V. griffithi* from Kandahar, in the British Museum, measures 4·3 inches in basal length, and is of the same size as a rather large skull of *V. leucopus* from Rájputána. I am indebted to Mr. Theobald for two specimens of a fox, which I believe is typical *V. pusilla*, from the Potwár in the northern Punjab, and except a trifling difference in size, both agree perfectly with skins of *V. leucopus* from Sind, whilst they are the same size as large specimens of *V. leucopus* from Rájputána.

There is some confusion as to *V. griffithi*, for whilst it is founded on the smaller fox of Afghanistan, the dimensions given by Hutton (J. A. S. B. xiv, p. 344),—head and body 2 feet, tail 17 inches, height at shoulder 14 to 15—agree better with the larger form.

The species described by me in 1875 (A. M. N. H. ser. 4, xvi, p. 310, and 'Eastern Persia,' ii, p. 39) as *V. persica* is possibly identical with *V. leucopus*, though larger.

Distribution. *V. leucopus* inhabits the dry and semi-desert regions of Western India, Sind, Cutch, Rájputána, the Punjab, and the North-west Provinces as far east as Fatigarh. It is also found in Baluchistan and Afghanistan, and seems widely distributed in South-western Asia, as I have specimens from Muscat in Arabia.

Habits. This is essentially a desert animal, and in India keeps much to sandy wastes, where it appears to live chiefly on the sand-rats, *Gerbillus hurrianæ.* Jerdon remarks that the present species keeps to a different kind of ground from that inhabited by *V. bengalensis*, but in Sind both are common on the waste land with scattered bushes that covers so large a portion of the province.

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V. leucopus, however, appears to be the only form actually found amongst the sand-hills of the desert. The habits, so far as they are known, exhibit no peculiarity. Jerdon considers this fox more speedy than *V. bengalensis* and capable of giving a capital run even with English greyhounds.

75. **Vulpes alopex.** *The common Fox.*

Canis vulpes *and* C. alopex, *Linn. Syst. Nat.* i, p. 59 (1766).
Canis vulpes montana, *Pearson, J. A. S. B.* v, p. 313 (1836).
Canis himalaicus, *Ogilby, P. Z. S.* 1836, p. 103.
Vulpes nipalensis, *Gray, Charlesworth's Mag. N. H.* i, p. 578 (1838).
Vulpes montanus, *Blyth, J. A. S. B.* xi, p. 589, xxiii, p. 730; *Adams, P. Z. S.* 1858, p. 516; *Jerdon, Mam. Ind.* p. 152; *Blanf. J. A. S. B.* xlvi, p. 323, xlviii, p. 95; *Scully, P. Z. S.* 1881, p. 202; *id. A. M. N. H.* ser. 5, viii, p. 225.
Vulpes flavescens, *Gray, A. M. N. H.* (1) xi, p. 118 (1843); *Hutton, J. A. S. B.* xiv, p. 344; *Adams, P. Z. S.* 1858, p. 516; *Blyth, Cat.* p. 42; *Blanford, Yark. Miss., Mam.* p. 22, pl. ii.
Vulpes alopex, *Blanford, P. Z. S.* 1887, p. 635.

Lomri, H.; *Rubah*, Pers.; *Luh* ♂, *Laash* ♀, Kashmiri; *Wamu*, Nepal.

A large, and, in winter, richly-coloured fox with long fur and a superb brush. The skull is elongate, but the muzzle is less narrow proportionally than in the smaller Indian forms.

Colour of the Himalayan variety. Middle of the back varying from pure chestnut to dull rufous, speckled with white or yellow, or to dark iron-grey (black and rufous mixed). The cross stripe on the shoulder sometimes scarcely apparent, in other skins very distinct and with well-marked buff patches on each side before and behind. The hinder part of the back and the thighs much greyer and more speckled with white; the sides paler in colour; lower parts varying from creamy-white to almost black, being probably much paler in summer than in winter. There is generally a white spot in the middle of the chest, which, with the throat, is often much darker than the belly, or the dusky portion of the latter may be confined to a median band. The woolly underfur on the back purplish brown; terminal portion of longer hairs rusty-red, with generally a white or whitish ring near the end, the extreme tip often black. The underfur of other parts of the body varies from yellowish white to dusky. The ears are black outside, light rufous or buff within. The face is rufous; there is a large black spot in front of the eye, and the cheeks are white. The outside of the limbs are ferruginous, black and white mixed, sometimes one colour prevailing, sometimes the other. Tail greyish, more or less rufous, many of the hairs with black tips, but the end of the tail is conspicuously white.

In spring, when the long winter fur is shed, the animal can scarcely be recognized; the dark underfur gives a greyish-brown tinge to the back, whilst the sides are pale and the lower parts whitish.

Dimensions of Himalayan specimens. Length of head and body 24 to 25 inches, tail with hair at the end 18 to 20, without 14½ to 17, tarsus and hind foot nearly 6, height 14 to 15 inches; weight (according to Jerdon) 14 lbs. A Himalayan skull measures 4·9 inches in basal length by 2·7 broad.

Varieties. There is a considerable amount of variation, both in size and colour, exhibited by the different races of the common fox, and there is, as yet, much difference of opinion amongst naturalists as to whether these different races should be distinguished by specific names. The fox of Northern and Central Europe is rather larger than the Himalayan fox and much redder; but the variety inhabiting Southern Europe, *Canis melanogaster* of Bonaparte, approaches more nearly in colour to the Himalayan race. The large Central-Asian fox, *V. flavescens*, Gray, is a paler-coloured and yellower animal as a rule, with very thick fur in winter and a superb brush. It occurs within our limits in Ladák and other parts of Western Tibet, and is found throughout Eastern Tibet and in some of the higher Himalayan valleys south of the main range; also in Eastern Turkestan, Northern Persia, and probably in other parts of Central Asia. It is also, I believe, the form found in Afghanistan. I have not been able to examine any series of skulls from other localities, but those from Eastern Turkestan are larger than Himalayan specimens (one of a female measures 5·45 inches long and 3·15 broad), and equal in size to those of the European fox, whilst the teeth are larger even than in the latter. But it is extremely doubtful if these characters are constant, for there is much variation amongst European foxes. It appears to me that all the large Palæarctic red foxes, together with the North-American cross-fox, *C. fulvus* or *pennsylvanicus*, must be considered varieties or races of one species.

Distribution. Of these races two are found within the limits of the Indian fauna—*V. alopex* var. *montana* of the Western Himalayas, which is described above and is found from Nepal to Kashmir and Gilgit; and *V. alopex* var. *flavescens*, the paler, rather larger Central-Asiatic form, occurring in the higher Himalayas, in Tibet, and probably in Afghanistan. No foxes are known to occur in Sikhim or the Eastern Himalayas except close to the snows, and it is doubtful whether any are found in Nepal. Hodgson's specimens were from Simla. Beyond Indian limits the species is found throughout the greater part of the Palæarctic and (if the views above expressed be correct) Nearctic regions.

Habits. The Himalayan fox lives in brushwood and cultivated land, from an elevation of 5000 or 6000 feet upwards, frequently haunting the neighbourhood of human habitations and feeding upon such birds and small mammals as he can capture. He is very destructive to partridges, pheasants, and other game-birds, and often carries off poultry. In Europe, wherever rabbits are common, foxes live chiefly upon them. The Central-Asiatic variety lives in open country, hiding in burrows or amongst bushes or rocks by day. Like all other foxes, this species, besides killing

GSL

birds and small mammals, feeds upon insects of various kinds, on the combs and honey of wild bees, on eggs, and on fruits and berries, and is especially fond of grapes. Occasionally it eats carrion. In winter, Captain Hutton says, when the snow is on the ground, these animals are very numerous about Simla, and come close to the houses in search of offal and other food.

Foxes generally live and breed in burrows, but sometimes in holes amongst rocks. The breeding-time is at the end of winter; the period of gestation 9 weeks; the young, usually five to seven in number (in the Himalayas, it is stated by Hutton, only three or four), are produced about the end of March or in April; they are born blind, and remain so for a fortnight. They are full-grown in the autumn, and sometimes breed again the first year. Foxes live thirteen or fourteen years.

In Kashmir Jerdon mentions that in 1865 the 7th Hussars had a pack of hounds and killed many foxes. There are, however, but few localities where the Himalayan fox can be hunted.

76. **Vulpes ferrilatus.** *The small Tibetan Fox.*

Vulpes ferrilatus, *Hodgson, J. A. S. B.* xi, p. 278, pl.
Cynalopex ferrilatus, *Blyth, Cat. Mam.* p. 41.

Iyur, Tibetan.

Size considerably less than that of *V. alopex*. Ears short; brush well developed; fur long, especially on the legs and feet.

Colour. On the back ochraceous, finely speckled with white, the general tint being a pale yellowish rusty; face and outside of ears similar, but rather greyer and less yellow; sides of the neck, breast, and body, and the greater part of the tail nearly pure grey, mixed black and white; tip of the tail white; outside of the limbs yellowish rufous; lower parts white, the middle of the breast conspicuously white and distinct from the dark grey sides. Dorsal fur light grey at the base, then pale rufous, becoming darker near the end, the tips of the longer hairs white, black tips being intermixed, rarely on the back but abundantly on the sides, and especially on the tail except towards the tip. Vibrissæ black.

Dimensions. None are available from fresh specimens. In a skin the head and body measure 24½ inches, tail without the terminal hairs 9½, with the hairs 11, ear outside 2 inches. According to Hodgson, a skull not mature was 4⅝ inches long and 2½ broad.

Distribution. Tibet, around Lhassa. Stoliczka (J. A. S. B. xxxvii, pt. 2, p. 5) includes this fox among the animals found in the Upper Sutlej valley, but the species does not appear hitherto to have been observed elsewhere within British limits. Its habits are unknown.

GSL

ARCTOIDEA.

Family MUSTELIDÆ.

The first family in the third of the great groups into which the typical Carnivora have been divided contains the martens and weasels, the badgers and the otters, an assemblage of animals varying more in external conformation, and also in the characters of the teeth, than is the case in any other family of Carnivora. All agree in the possession of a single upper true molar on each side, and all have two lower molars in each ramus of the mandible except *Mellivora*, which has but one. The number of premolars is variable, and even that of the incisors is not constant. There is no alisphenoid canal. Several genera possess the power of diffusing at will from their anal glands an excessively fœtid fluid. Five toes occur on all feet.

The *Mustelidæ* are somewhat difficult of arrangement when all the genera are taken into consideration; but the Indian forms fall easily and naturally into the three subfamilies amongst which the types belonging to the family have been distributed. These subfamilies are readily distinguished by the characters of the feet and claws.

A. Toes short, partially webbed; claws short, compressed, acute, curved, often semiretractile. Upper posterior molar of moderate size, elongate transversely. Terrestrial and arboreal........	*Mustelinæ*.
B. Foot elongated; toes straight; claws non-retractile, slightly curved, non-compressed, blunt, those of the fore feet especially large. Upper posterior molar variable. Habits mostly terrestrial and fossorial	*Melinæ*.
C. Feet short, rounded; toes webbed; claws small, curved, blunt. Head broad and much depressed. Upper posterior molar large and quadrate. Habits aquatic...........................	*Lutrinæ*.

The above arrangement is identical with Blyth's in his 'Catalogue of the Mammalia in the Museum of the Asiatic Society,' but Jerdon classed the badgers and their allies in a distinct family apart from the weasels and otters.

Throughout the *Mustelidæ* the form of the skull changes with age, even more than in other Carnivora. The breadth across the zygomatic arches increases, whilst the width of the skull between the orbits diminishes to an extraordinary degree. The sagittal and occipital crests increase long after the animal is fully adult. There is also in many forms a great sexual difference in size. A remarkable example is described by Mr. Thomas (P. Z. S. 1886, p. 125).

GSL

Subfamily MUSTELINÆ.

The Indian genera of this subfamily are typical forms with a long body and short limbs. The majority of the subfamily are found in the Northern regions of both continents; several occur in the Himalayas, but only one species is known to exist in the Indian Peninsula and in Burma. Two genera are found within Indian limits.

Teeth in molar series on each side 5 above, 6 below. Lower sectorial with inner tubercle. Size about that of a domestic cat	MUSTELA.
Teeth in molar series 4 above, 5 below. No inner tubercle to lower sectorial. Size small..............	PUTORIUS.

By most English naturalists the name *Martes* is used for the martens (*Mustela*), and *Mustela* for weasels and polecats. I have given elsewhere (P. Z. S. 1887, p. 636) my reasons for preferring the nomenclature of French and German writers.

Genus **MUSTELA**, Linn., 1766.

Syn. *Martes*, Nilsson.

Body long and slender; limbs short; tail of considerable length. Feet digitigrade or nearly so; toes short; claws compressed, curved, sharp, semiretractile.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{1-1}{2-2}$. Upper sectorial with the inner lobe close to the anterior end. Upper true molar nearly the same size as the sectorial. Lower sectorial with small inner tubercle. Vertebræ: C. 7, D. 14–15, L. 5–6, S. 3, C. 18–24.

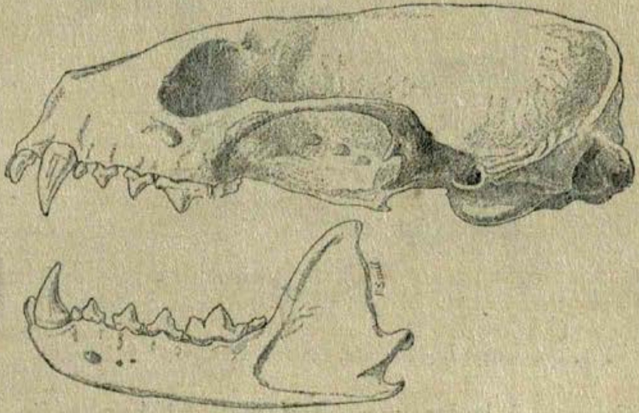

Fig. 38.—Skull of *Mustela flavigula*.

The martens are animals about the size of a domestic cat, more or less arboreal in their habits, and with but little, if any, disagreeable scent.

Synopsis of Indian and Burmese Species.

A. Tail without hair three fourths the length of the head and body	*M. flavigula*, p. 158.
B. Tail without hair one half the length of the head and body	*M. foina*, p. 160.

A trace of a fossil *Mustela* has been found in the Siwalik beds. From the fragments found, the species appears to have been similar to *M. flavigula*.

77. **Mustela flavigula.** *The Indian Marten.*

Mustela flavigula, *Bodd. Elench. An.* p. 88 (1785); *Cantor, J. A. S. B.* xv, p. 194.

Martes flavigula, *Blyth, J. A. S. B.* xxvi, p. 316; *id. P. Z. S.* 1864, p. 485; *id. Mam. Birds Burma*, p. 29; *Adams, P. Z. S.* 1858, p. 516; *Jerdon, Mam.* p. 82; *Blanf. J. A. S. B.* xlvii, pt. 2, p. 156.

Galidictis chrysogaster, *Jardine, Nat. Lib.* xiii, p. 167, pl. vii (1842).

Martes gwatkinsi, *Horsfield, Cat.* p. 99 (1851).

Kasia, Sirmur; *Tuturala*, *Chitrála*, Kumaon and Garhwal; *Múl sampra*, Nepal; *Huniah*, Bhot.; *Sakku*, Lepcha; *Anga Prao*, Malay.

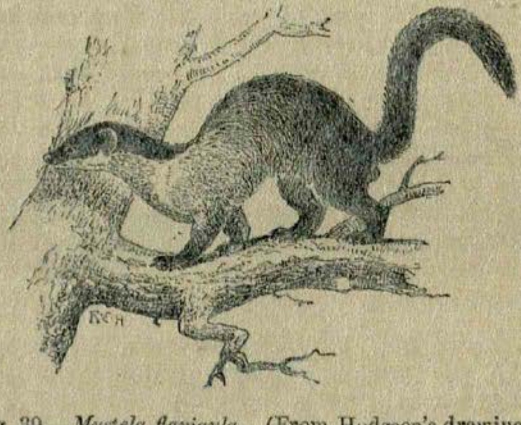

Fig. 39.—*Mustela flavigula.* (From Hodgson's drawings.)

Tail long and bushy, measuring, without hair, quite three quarters the length of the head and body. Caudal vertebræ 24. Feet more or less naked beneath; in Malay specimens the whole metacarpus and more than half the tarsus being bare, whilst in some Himalayan animals the naked soles appear less developed. Short hairs separate the pads from each other and from the central

GSL

pad. Fur of body short in Malay skins, moderately long in Himalayan specimens, and with woolly underfur in winter.

The skull resembles that of *M. foina* more than that of *M. martes* in shape, but is larger than either, the zygomatic breadth exceeds half the length, and the sides of the muzzle converge. The length of the upper sectorial along its outer margin exceeds the breadth of the upper true (hindmost) molar. This molar differs in form from that in *M. foina* and *M. martes* by having the inner lobe no broader from back to front than the outer.

Colour. In the common Indian form the head to below the ears, with the face, nape, and more or less of the hind neck, the rump, tail, and limbs glossy blackish brown to black, the back from the shoulders to the rump pale brown, sometimes brownish white. The chin and upper part of the throat as far as below the ears white; throat and breast yellow or orange or brownish yellow; abdomen similar in colour to the back, but a little paler. The underfur on the back is paler in colour than the terminal portions of the longer hairs.

Varieties. There is, however, a much darker form, found both in the Himalayas and in Southern India, the *Galidictis chrysogaster* of Jardine and *Martes gwatkinsi* of Horsfield. The whole animal is dark brown, except the chin, throat, and breast, the two former of which are white, the breast pale yellow. According to Adams, the dark phase is the summer livery, but this requires confirmation. Another variety, found in Southern Tenasserim and the Malay countries, has the head above and the back uniform or nearly so in colour, a moderate hair-brown, not nearly so dark as the head in ordinary specimens, but with a darker band on each side of the nape, forming a margin to the paler throat, which is not always white or yellow, but sometimes, with the breast, light brown. The Malayan race, however, is not, as Jerdon states, paler than others, but the reverse, except on the head. There is, in the British Museum, a blackish-headed specimen from Tavoy, with the back very pale light yellowish brown, this colour extending to the base of the tail. Four different varieties are described by Blyth, one from Southern India being very similar in colour to some Malay specimens, brown throughout, paler on the sides, chin, throat, and breast. In some instances dark brown spots are found on the throat or breast.

Dimensions. Head and body 20 to 22 inches, tail without hair about 16, with hair 17 to 20 (Jerdon's measurement of the tail is erroneous). Weight 4 to 6¾ lbs. Basal length of skull 3·53 inches, zygomatic breadth 2·3 inches.

Distribution. Throughout the Himalayas from west of Kashmir (I have a skin from Hazára collected by Mr. A. B. Wynne) to the eastern extremity of Assam, at elevations not exceeding 7000 to 8000 feet, also throughout the hilly part of Burma, the Malay Peninsula, and Sumatra. *M. flavigula* is also found in Southern China and even in Amurland (*Radde*). In the Peninsula of India this marten is found on the Nilgiri hills, on the Travancore ranges, and probably on some of the other higher portions of the Western Ghats, but it does not appear to have been recorded in this range north of the Nilgiris. Jerdon says it is found in Ceylon, but I cannot find any notice of its occurrence there.

Habits. The Indian marten lives in hill-forests, and is not unfrequently seen in the daytime, sometimes in pairs, occasionally in families of five or six, hunting among brushwood or on the branches of trees. "When moving about, it is constantly uttering a low chuckle, which is prolonged into a harsh cry when the animal is excited" (*Adams*). It lives upon birds and their eggs and small mammals, and it is said to kill young deer. It also feeds on reptiles and fruits, and probably on insects, one having been shot by Mr. Bourdillon on a tree in the Travancore hills, apparently in the act of feeding upon cicadas.

This species is said to be easily tamed. Nothing is recorded about its breeding-habits, which probably resemble those of other members of the genus. It has a very slight unpleasant odour.

78. **Mustela foina.** *The beech Marten.*

Mustela foina, *Erxleben, Syst. Regn. An.* p. 458 (1777).
Martes foina, *Nilsson, Faun. Scand.* i, p. 38 (1820); *Alston, P. Z. S.* 1879, p. 469; *Scully, P. Z. S.* 1881, p. 202; *id. A. M. N. H.* (5) viii, p. 96.
Martes toufæus, *Blyth, J. A. S. B.* xvi, p. 353, partim; *id. Cat.* p. 66, *nec Hodgson.*
Martes abietum, *Horsf. Cat.* p. 101; *Adams, P. Z. S.* 1858, p. 517, *nec Ray.*
Martes leucolachnæa, *W. Blanford, Yark. Miss., Mam.* p. 26.

Dalla kafak, Afghanistan.

Tail covered with long hair, and measuring without the hair about half the length of the head and body. Caudal vertebræ about 21. Feet with long hair between the toes, so that the naked pads are much concealed, especially in winter, when the hair is much longer. Body covered in winter with long glossy hair and thick soft woolly underfur. Skull broad, muzzle short with the sides slightly converging. Length of upper sectorial along the outer edge greater than breadth of upper true molar. The inner lobe of the last tooth, the hindmost in the upper jaw, is a very little broader from front to back than the outer lobe, the outer margin of the latter distinctly indented between the two cusps.

Colour. Varying from greyish brown or even whitish brown or brownish grey to deep blackish brown, the tail and limbs usually rather darker than the body; throat and breast white, the extent of the white varying. The underfur varies from ashy to pure white.

In general the fur of this species is inferior to that of the pine-marten, *M. martes*; but some Afghan and Turkestan skins of *M. foina* have beautiful fur, with long, glossy, nearly black piles and

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very soft white or pale ashy underfur. This is the variety for which I proposed the name *leucolachnæa*.

Dimensions. Head and body 18 inches, tail without hair 10, with hair 13. Basal length of skull 2·85, zygomatic breadth 1·8.

Distribution. Throughout the greater part of Europe, but not in the extreme north, and in Western Asia. This marten occurs in Afghanistan and probably throughout the greater part of the Himalaya at considerable elevations; specimens have been recorded from Gilgit, Ladák, and Kumaon, and I possess one procured by the late Mr. Mandelli from Upper Sikhim or the neighbouring portion of Tibet. The species has not been found further east.

Habits. Nothing has been recorded of the habits of *M. foina* in the Himalayas, except that Scully states, in Gilgit, that it keeps to considerable elevations and is but rarely found in the vicinity of villages as low as 5000 feet. In Europe it is more common than the pine-marten, though the latter, as Alston has shown, is the only form occurring in Britain. The beech-marten is bolder than the pine-marten and more often found about human habitations; it lives in trees or amongst rocks, and feeds chiefly upon birds or small mammals, frequently destroying poultry. It is very bloodthirsty, killing more than it requires for food. When pressed by hunger it will eat lizards, snakes, frogs, or fruit, and is said to be very fond of cherries. The pairing-time is about February, the period of gestation 9 weeks, the number of young usually 4 or 5, and they remain blind for 14 days from their birth. Young individuals are easily tamed, and indeed there is good reason for believing that the animal was domesticated by the Greeks and Romans and kept for the same uses as cats are now (see Rolleston, Journ. Anat. Phys. 1868, ii, p. 47).

Martes? toufœus of Hodgson (J. A. S. B. xi, p. 281) was founded upon three furrier's skins that had been brought from Tibet, without skull, tail, or feet. These skins are now in the British Museum and have been labelled *M. zibellina*, the sable, to which they may perhaps belong. The fur is very soft, the underfur brownish, not at all like that of *M. foina*. They are very different from the specimens identified with *M. toufœus* by Blyth.

Mustela martes (*Martes abietum* of many English writers), the pine-marten, is easily distinguished from *M. foina* by its narrower skull and differently shaped upper sectorial and true molar (see Alston, P. Z. S. 1879, p. 469). The sable appears to represent the pine-marten in Eastern Asia, and is by some considered only a variety of the latter.

Genus PUTORIUS, Cuv. 1817.

Syn. *Mustela*, auct. nec Cuvier.

Body very long, slender, and typically vermiform, limbs very short, tail variable. The external characters are similar to those of *Mustela*, except that the body, in the typical weasels especially, is even more elongate.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{1-1}{2-2}$. The principal difference from the martens consists in the absence of the anterior premolar in both jaws, in the cusps of the teeth being sharper, and in the absence of the inner tubercle from the lower sectorial. The skull is elongate behind the orbits, but the muzzle is short. Vertebræ C. 7, D. 14–15, L. 5–6, S. 3, C. 15–21.

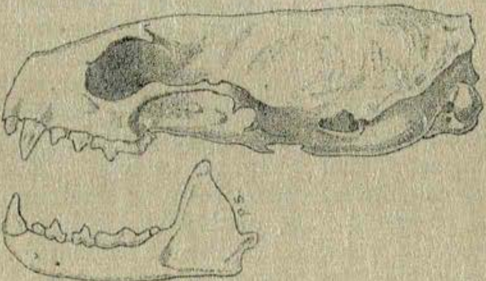

Fig. 40.—Skull of *Putorius canigula*.

The forms comprised are the animals known as weasels, polecats, ferrets, and minks, of which many species occur in the northern parts of both hemispheres, and several inhabit the Himalayas, one at least extending to the hills south of the Assam valley, and another, not hitherto recorded within Indian limits, inhabiting the Malay Peninsula. None are found in the Peninsula of India.

All the species are thoroughly carnivorous and excessively sanguinary and bold, killing, if an opportunity offers, far more than they can consume, and destroying animals much larger than themselves.

Synopsis of Indian Species.

A. Limbs and lower surface darker than upper parts. (Polecats.)
  a. Back fulvous, longer hairs black-tipped *P. larvatus*, p. 163.
  b. Back variegated with white and dark brown . . . . *P. sarmaticus*, p. 164.
B. Lower surface not darker. (Weasels.)
  a. Tail-tip dusky or black.
    a'. Lower parts white; whole body white in winter . . . . *P. erminea*, p. 165.
    b'. Lower parts brown . . . . *P. subhemachalanus*, p. 166.

b. Tail-tip not darker.
  a′. A pale median dorsal stripe ...... *P. strigidorsus*, p. 170.
  b′. No dorsal stripe.
    a″. Nose white .... *P. canigula*, p. 167.
    b″. Nose the same colour as forehead.
      α. Back dark reddish brown .... *P. cathia*, p. 169.
      β. Back light brown .... *P. alpinus*, p. 168.

79. **Putorius larvatus.** *The Tibetan Polecat.*

Putorius larvatus, *Hodgs. J. A. S. B.* xviii, p. 447, pls. xi, xii (1849).
Putorius tibetanus, *Horsfield, Cat.* p. 105.

Tail without hair less than half the length of the head and body. Fur long, with much woolly underfur. Long hair between the toes greatly concealing the naked toe-pads. Metatarsus thickly furred. Claws sharp.

The skull figured by Hodgson, the only one of the Tibetan form known, is immature, the sutures being all open, although the dentition is adult. The hamular process of each pterygoid bone, which in *P. fœtidus*, the common European polecat, is much curved outwards, in the skull of *P. larvatus* is but slightly curved, and is in contact with a process projecting forwards from the anterior portion of the bulla, as in *P. sarmaticus*. The upper true molar is dumbbell-shaped, the inner lobe being broader than the outer.

Colour. Above dirty whitish or fulvous with a black wash, especially between the shoulders and on the hinder part of the back, owing to the long black tips on some of the longer hairs. Underfur whitish throughout. Part of the face between the eyes brown (perhaps black or blackish, as described by Hodgson, in fresh specimens), the tip of the nose and the chin white. The throat, breast, all the limbs, the groin, and the tail except near the base blackish brown, abdomen whitish.

Dimensions. Hodgson gives the following:—head and body 14 to 16 inches, tail with hair at the end 7, without 6, planta with nails $2\frac{3}{8}$ (in another $3\frac{1}{2}$).

Distribution. A specimen was procured by Captain (now General) Strachey in Ladák, others by Hodgson from the Utsang district of Tibet north of Sikhim.

Habits. Probably precisely the same as those of the common European polecat, which is particularly distinguished amongst the weasel tribe for the evil odour generated by the secretion of its anal glands, whence its name of foumart or foul marten. It lives in woods and thickets, often near human habitations. *P. larvatus* probably inhabits a less wooded country and hides, like many other species of martens and weasels, amongst stones. The common polecat is very sanguinary and bold, and singularly destructive to game and poultry: it also feeds on frogs and toads. The period of gestation is about 9 weeks, the young, usually 5 to 7 in number, are born about April, in hollow trees or amongst rocks or stones.

The common ferret is a domesticated variety of the polecat.

Externally *P. larvatus* closely resembles *P. eversmanni* (Lesson, Man. Mam. p. 144) of Western and Northern Asia in form and coloration, but in none of the three skulls of that species in the British Museum is there a process connecting the pterygoid bone with the bulla. The form of the upper true molar, too, appears to me different. *P. putorinus* (Blyth, J. A. S. B. xi, p. 281, note) is evidently the same as *P. eversmanni.*

80. **Putorius sarmaticus.** *The mottled Polecat.*

Mustela sarmatica, *Pallas, Reise*, i, p. 453 (1771); *Hutton, J. A. S. B.* xiv, p. 346; *Blyth, Cat.* p. 68; *Scully, A. M. N. H.* ser. 5, viii, p. 227.

Tail bushy, about half the length of the head and body. Fur shorter and more even than in the common or Tibetan polecats. Very little woolly underfur, the longer hairs coarse and glossy.

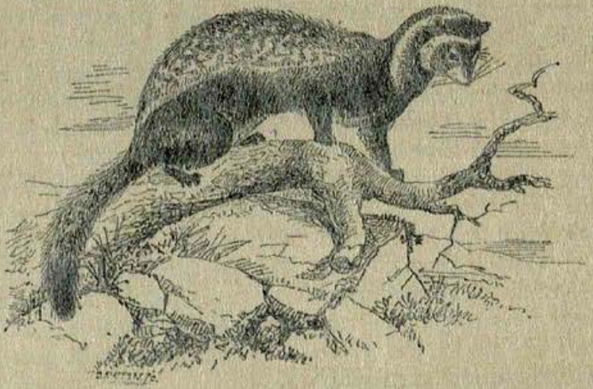

Fig. 41.—*Putorius sarmaticus.*

Skull similar in form to that of the common polecat, not pinched in behind the postorbital processes. The hamular process of the pterygoid on each side is nearly straight, and meets a process running forward from the anterior portion of the bulla, leaving a foramen below, which is nearly or quite filled up in old skulls, so that the mesopterygoid fossa is continued back to between the bullæ. Crowns of upper true molars not dumbbell-shaped, but of approximately the same width from front to back throughout.

Colour. Upper parts variegated with brown and yellowish white, underfur on the back greyish brown. Lower parts from the chin, with the limbs, glossy black. Face dark brown to black, except a white band across the forehead. Another band passes across the nape, and includes the upper portion of the ears; the two bands nearly or quite meet below the ears. Hind neck dark brown; there is generally a broad fairly marked whitish band behind each shoulder. The hairs on the tail are very pale brown at the base, then dark

GSL

brown; the terminal portion white, except at the end of the tail where all the tips of the hairs are black.

Dimensions. Head and body 13 inches, tail without hair 6¼; weight 8 to 12 ounces. Skull (of a female) 2·05 long (basal length), 1·3 broad across the zygomatic arches.

Distribution. Eastern Europe and parts of Western Asia, generally very rare, but common in South Afghanistan about Kandahar and Quetta. It has been obtained at or near the latter locality by Captain Hutton and Dr. Leith, and, as I learn from Sir O. B. St. John, occurs in Pishin, north of Quetta.

Habits. An excellent account of this animal is given by Hutton, very little about it having been recorded in Europe. It lives in the ground in burrows (probably made by rats originally), and appears to be equally common in cultivation and in uncultivated tracts. It is chiefly nocturnal, but is occasionally seen abroad hunting in the daytime. It feeds on birds, rats, mice, lizards, beetles, and snails, and probably, like the common polecat, on any animals that it can master, and is excessively sanguinary. A caged animal kept by Hutton killed in succession 4 wagtails and 4 rats, two of the latter full-grown and large. The rats were always seized in the same place, just behind the ear, held until they ceased to struggle, and then killed by one or two bites through the back of the skull. As the blood flowed from the wounds, the polecat lapped it up, but never attempted to suck it. Although the animal that slaughtered all these birds and rats had been fasting for some time, it made no attempt to eat its victims during the day, but stored the bodies in a portion of its cage divided off as a sleeping apartment, and only fed after nightfall. The whole account given (*l. c.*) is too long to copy, but is worth reading.

The young are produced in holes about the end of March or beginning of April and are usually three or four in number.

This species has the same disagreeable fœtid odour that is characteristic of the common polecat.

81. **Putorius erminea.** *The Ermine or Stoat.*

Mustela erminea, *L. Syst. Nat.* i, p. 68 (1766); *Hodgson, J. A. S. B.* vi, p. 564, x, p. 909, xi, p. 280; *Horsf. Cat.* p. 104; *Blyth, Cat.* p. 68; *Blanf. Yark. Miss., Mam.* p. 32.

Body very slender. Tail about a third the length of the head and body. Soles of feet covered with hair except the small toe-pads. Fur soft, with woolly underfur.

Skull elongate, muzzle very short. The bony palate continues back for more than half the distance between the last molars and the end of the pterygoids, which are simple at the end, not curved outwards, nor is there any process opposite to them projecting from the bulla. Upper molar concave before and behind, so as to be slightly dumbbell-shaped, and slightly emarginate posteriorly on the outer edge.

Colour. In summer dull chestnut (reddish brown) above, white or yellowish white below, the terminal portion of the tail black. The underfur on the back paler. In winter the whole of the fur is white except the tail towards its extremity, which remains black. In some countries, as in England, the white winter garb is seldom assumed.

Dimensions. Head and body 9 to 11 inches, tail with hair 4½ to 6, without hair about 3 to 4. Males are larger than females. A skull measures 1·7 in basal length, and 1 inch in breadth across the zygomatic arches.

Distribution. Throughout the Palæarctic region as far south as the Alps and the Himalayas. A specimen was obtained in Afghanistan by Griffith, and the species was recorded from Nepal by Hodgson; but the only specimen made over by him to the British Museum is a furrier's skin, said to have been brought from Tibet. Adams says the species is found in the lower and middle regions of the Western Himalayas, but Jerdon very pertinently remarks that no Himalayan examples exist in any of our museums. Indeed the only thoroughly authentic occurrence within our area appears to be that mentioned by Dr. G. Henderson in 'Lahore to Yarkand,' p. 42. He shot a specimen near Dras, north of the Zoji-la, Kashmir. The skin is, I believe, that now preserved in the Indian Museum, Calcutta. Dr. Henderson remarked that the animal was probably rare in the locality, for the people had no name for it.

Habits. The ermine lives in holes in the ground made by rodents, amongst rocks or heaps of stones, or in hollow trees, sometimes hunting in the daytime, but more frequently at night, and killing any mammals, birds, or reptiles that it can master. It kills rats and mice of all kinds, and is well known to be very destructive to rabbits and to feathered game generally. It climbs well, and plunders birds' nests of eggs and young. It is bold and sanguinary. In Europe it pairs in February or March, and has young, usually 5 to 8 in number, in April or May; the latter are blind for 9 days, remain with the mother till the autumn, and are full-grown in the following spring.

The white winter skins from the North, where the fur is thick and close, form the valuable ermine of commerce.

82. **Putorius subhemachalanus.** *The Himalayan Weasel.*

Mustela (Putorius) subhemachalana, *Hodgson, J. A. S. B.* vi, p. 563 (1837); *Horsf. Cat.* p. 103; *Jerdon, Mam.* p. 83.
Mustela humeralis, *Blyth, J. A. S. B.* xi, p. 99.
Mustela horsfieldii, *Gray, A. M. N. H.* xi, p. 118 (1843).
Mustela hodgsoni, *Horsf. Cat.* p. 103, *nec Gray.*

? *Kran* or *Gran*, Kashmir *; *Sang-king*, Lepcha; *Temon*, Bhot.

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* See under *P. canigula.*

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Tail moderately bushy, and, without including the hair at the end, nearly half the length of the head and body. Fur moderately long, soft, with some woolly underfur. Soles hairy; long hair between the toe-pads, and between them and the palmar and plantar pads, sometimes almost concealing them. Anal glands as in other species.

Skull more elongate than that of *P. erminea*, and muzzle narrower; otherwise similar. The dentition presents no difference of importance.

Colour. Brownish red, ranging from bright chestnut to bay, some being considerably brighter and more rufous in tint than others; underfur hair-brown. The tip of the tail and the nose are darker, but not black. Chin white, and in many specimens there are white spots or patches on the breast.

Dimensions. Head and body in a large (? male) specimen 15½ inches, tail without hair 6, with hair 7½, tarsus and hind foot 1¾. In a small (? female) example the corresponding measurements are 10, 4, 5, and 1½ inches. Weight of a young male 9 ounces. A skull measures 1·85 inches in basal length, and nearly 1 inch in zygomatic breadth.

Distribution. This weasel is found in Nepal and Sikhim at elevations from 7000 to 13,000 feet (I have a specimen procured on Chola by Mr. Elwes at the last-named elevation, and Hodgson caught two in his house at Darjiling). Blyth (J. A. S. B. xxiii, p. 215) records specimens collected by Dr. Stewart near Landour and Mussoorie, and Jerdon states that the species is common in Kashmir, where Leith Adams also records its occurrence; but all the skins I have seen from the Western Himalayas belong to the next species. The specimen procured by Griffith, and erroneously referred by Horsfield to *M. hodgsoni*, is labelled from Afghanistan. Some of Griffith's collections thus labelled were from the Khási hills, so no dependence can be placed upon the locality.

Varieties. The type of *Mustela horsfieldi*, which was brought from Bhutan, is now in the British Museum. It is smaller and much darker-coloured than Hodgson's type of *M. subhemachalana* in the same collection. But the tint is evidently variable in this species, and as the distribution of colour is precisely similar, I have very little doubt that the difference in size is sexual, and that the two are identical, as was suggested by Jerdon. In Hodgson's MS. drawings three of these darker specimens are represented, and all are noted as young.

Nothing is known of the habits of this weasel.

83. **Putorius canigula.** *The white-nosed Weasel.*

Mustela canigula, *Hodgson, J. A. S. B.* xi, p. 279 (1842).
Mustela hodgsoni, *Gray, A. M. N. H.* xi, p. 118 (1843).

Tail moderately bushy, about half the length of the head and body. Fur of moderate length Soles hairy.

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Skull (fig. 40, p. 162) decidedly elongate, the comparatively narrow area behind the postorbital processes very long, but nowhere distinctly contracted, the sides being subparallel.

Colour. Chestnut (brownish red), some specimens darker than others, some being bright chestnut, almost fawn-colour, the tail-tip not darker. Underfur hair-brown. The nose as far back as the eyes, both lips, the chin, and a variable area on the throat and upper breast white.

Dimensions. Head and body 15½ inches, tail without hair 7½, with hair 9½. The above are Hodgson's measurements, but are from a skin, and therefore only approximate. A skull from Kashmir is 2·05 inches in basal length, 1·1 broad across the zygomatic arches.

Distribution. Hodgson's types were from Lhassa in Tibet. There are specimens in the British Museum, collected by Major Kinloch, from Chamba and Pangi in the N.W. Himalayas, at an elevation of 8000 feet in each case. I have a skin obtained by Mr. Theobald at Dharmsala, and the species is probably that "with a white blaze on the face" observed by Mr. Lydekker in the Chenáb valley. I cannot help suspecting that this form may inhabit Kashmir, and that it may have been mistaken for its near ally *P. subhemachalanus*. If this be the case, *P. canigula* is probably the Western cis-Himalayan species, *P. subhemachalanus* the Eastern, the former extending further east, however, in Tibet.

Nothing particular is known of the habits of *P. canigula*.

The type of *Mustela hodgsoni*, Gray, is in the British Museum, and is a rather small and dark-coloured individual of the present species. The name has by Horsfield, Blyth, and Jerdon been applied to other kinds.

84. **Putorius alpinus.** *The pale Weasel.*

Mustela alpina, *Gebler, Mém. Soc. Imp. Nat. Moscou,* vi, p. 213 (1823); *Horsf. Cat.* p. 104.

Mustela temon, *Hodgson, J. A. S. B.* xxvi, p. 207; *Blanford, Yark. Miss., Mam.* p. 32; *Scully, P. Z. S.* 1881, p. 203; *id. A. M. N. H.* (5) viii, p. 97.

Temon, Tibetan.

Tail moderately hairy, about half the length of the head and body. Fur short, soft, very thick, with but little woolly underfur. Soles hairy, naked; pads much concealed by the long hair between them. Claws very slightly curved, blunt.

Colour. Above and on the sides light brown (or, as Hodgson calls it, brunnescent fawn) to hair-brown. Underfur rather darker brown at the base, then whitish when the fur is in good condition, the tips brown. Tail the same colour as the body or rather paler. Lower parts, as a rule, yellow or white, with a distinct line of separation from the brown of the sides; but in other specimens there is no distinct separation of colour, and the lower parts are

GSL

pale brown with a yellow or orange tinge. Forehead rather darker than the back; sides of the head paler brown; both lips, with the chin and the fore feet above, white, and frequently the inside surface of all the limbs and a small portion of the hind feet. Indistinct brown spots are sometimes found on the breast and abdomen.

Dimensions. The only measurements are from skins. Head and body 9½ to 11½ inches, tail without hair 5 to 5½, with hair about 6½, hind foot to calcaneum 1½. A skull from Hodgson's collection measures 1·82 in basal length, and 1 in breadth; another 1·7 by 0·97; whilst one from Kumaon is much smaller, only 1·5 by 0·82. The latter may be a female.

Distribution. Within our area this species has been obtained from the country on the northern frontier of Sikhim by Hodgson and Mandelli, from Kumaon by Strachey, and from Gilgit by Scully, and it probably occurs throughout the higher Himalayas and Tibet. The type of *P. alpinus* was from the Altai, and a species, said to be the same, was found in Amurland by Radde.

Habits. The typical *P. alpinus* is said by Gebler to have young in May, the number not exceeding five. The pairing-season is in February.

The typical skins and skulls of *P. temon* agree well with Gebler's description of *P. alpinus*, and with specimens from the Altai in the British Museum, but the individual from Kumaon, although similar in colour, is remarkably small, agreeing, however, in its dimensions with those given by Radde (Reis. Süd. Ost-Sib. i, p. 50) for the species. It is quite possible that the smaller individuals may be females.

85. **Putorius cathia.** *The yellow-bellied Weasel.*

Mustela (Putorius) kathiah, *Hodgson, J. A. S. B.* iv, p. 702; *Horsfield, Cat.* p. 102; *Jerdon, Mam.* p. 84.
Mustela auriventer *v.* cathia, *Hodgs. J. A. S. B.* x, p. 909, xi, p. 280.

Kathia nyal, Nepal.

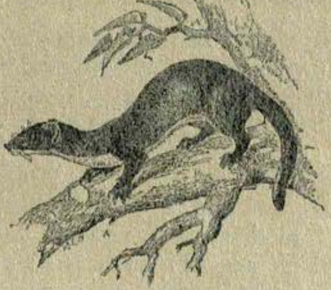

Fig. 42.—*Putorius cathia.* (From Hodgson's drawings.)

Tail about half the length of the head and body, not bushy.

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Fur short and even. Soles partly naked, especially those of the fore feet.

Skull resembling that of *P. erminea* in form, but narrower. The inner lobe of the upper true molar larger than the outer, and having the tubercle in the middle small but prominent, rising from the centre of a slight depression on the surface of the tooth.

Colour. Back, face, and upper surface of head, including the ears, limbs, and tail, bay (dark brownish red); underfur scarcely paler. Lower parts deep yellow, this colour extending to the inside of the limbs, but more in some specimens than in others; chin and upper lip generally whitish. In two specimens from Mussooree, collected by Captain Hutton and now in the British Museum, the inside of the fore legs is yellow to the feet, and in one the upper surface of the feet is partly whitish.

Dimensions. Head and body 9 to 10½ inches, tail without hair 5 to 6, with hair 6 to 7, tarsus and hind foot about 1½; weight about 6 ounces. A skull measures 1·8 inch in basal length, and 1 in zygomatic breadth. Males are rather larger than females.

Distribution. The Himalayas as far west as Mussooree, at moderate elevations (about 3000 to 8000 feet), and some of the hills south of Assam. There is a specimen from the Khási Hills in the Indian Museum, Calcutta.

Habits. Nothing is known about this animal in the wild state; its food, mode of hunting, breeding, &c., probably resemble those of other weasels and stoats. Hodgson states that it is easily tamed, and is employed by the Nepalese to rid houses of rats, for which purpose it is most efficient. It is also trained to attack larger animals—fowls, geese, and even goats and sheep—which it kills by dividing the artery of the neck.

86. **Putorius strigidorsus.** *The striped Weasel.*

Mustela strigidorsa, *Hodgs.*, *Gray* (*errore* strigodorsa), *P. Z. S.* 1853, p. 191; *Horsfield*, *A. M. N. H.* 2nd ser. xvi, p. 107; *id. P. Z. S.* 1856, p. 398, pl. xlix; *Jerdon, Mam.* p. 85.

Tail, without hair, nearly half the length of the head and body. Fur of moderate length; underfur soft and woolly, longer hairs coarse. Soles partly naked. A fœtid secretion exudes from the anal glands, which are similar to those of *P. cathia.* Mammæ 4, subinguinal.

Colour. Deep bay (dark brownish red) throughout, with the exception of the throat and middle of the breast, which are yellow; the chin, a narrow line down the middle of the back, and another along the belly, which are whitish or white. Underfur on the back a little paler than the terminal portions of the hairs.

Dimensions. Head and body 12 inches long, tail with hair 6½, without 5½, tarsus and hind foot 2; weight 7½ oz. The sex of the specimen measured by Hodgson, to whom we are indebted for the measurements, is not recorded. There is clearly a considerable difference in size between the sexes.

Distribution. This species has hitherto only been recorded from Sikhim, where two specimens were obtained by Hodgson, probably from a moderate elevation. Two more were procured by Mr. Mandelli, and are in my possession.

Nothing is known of the habits, which are doubtless similar to those of other allied forms. The animal is considerably larger than *P. cathia*, the teeth especially being of much greater size.

Two other species of *Putorius* may hereafter have to be included in the Indian fauna, though at the opposite extremities of the area. The first of these is a weasel described by myself from Eastern Turkestan under the name of *Mustela stoliczkana* (J. A. S. B. xlvi, pt. 2, p. 260, and Sc. Results 2nd Yarkand Mission, Mam. p. 30, pls. i *a*, ii *b*). This is allied to the common weasel of Europe, but is considerably larger and rather different in colour. The following is a brief description, which may suffice for identification.

P. stoliczkana.—Colour pale sandy brown above, on the outside of the limbs, and on the tail, white below. Fur short, dense, and soft. Head and body of a male 9 inches, tail with hair 3, without hair 2·3, tarsus and hind foot without claws 1·4; weight 5·2 oz. Skull 1·75 inches long, 1 broad.

There is a specimen from Afghanistan in the British Museum.

The other species is *P. nudipes*, F. Cuv. (Hist. Nat. Mamm. pl. 149), found in the Malay Peninsula (Cantor, J. A. S. B. xv, p. 194), Sumatra, and Borneo. Like so many other Malay species, this may inhabit Southern Tenasserim. A short description is consequently added:—

P. nudipes.—Tail bushy. Soles partly naked. Fur loose and long, with but little underfur. Colour rusty red, the head above and below white, tail-tip whitish. Head and body about 13 inches, tail without hair 8½, with hair 10½; skull 2·25 inches long, 1·35 broad. It is said by Cantor to inhabit the densest jungle.

P. astutus and *P. moupinensis* have been described by Prof. A. Milne-Edwards[*] from Moupin, Eastern Tibet, and *P. davidianus* from the Chinese province of Kiangsi. None of these can be satisfactorily identified with Himalayan forms.

P. astutus is dark rufous-brown above, the tail the same colour throughout; breast white, with a yellow tinge. Upper surface of fore feet white. Length of head and body nearly 10 inches, tail 4⅕, skull 1·8.

P. moupinensis is rufous-brown, a little paler below, the face and the tip of the tail darker; chin white or yellowish white. Head and body 13½ inches long, tail 9, skull 2·2. This approaches *P. subhemachalanus*, but has a longer tail.

P. davidianus is light rufous-brown above and below, the head above darker; no dark tip to the tail; chin, upper lip, and sides of nose white. In a female the head and body measure $11\frac{1}{2}$ inches, tail $6\frac{1}{2}$, skull 2. It is just possible that this may be a variety of *P. canigula*.

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[*] 'Recherches,' i, pp. 343–348.

In Gray's "Revision of the Genera and Species of *Mustelidæ* contained in the British Museum" (P. Z. S. 1865, p. 117), and in the same author's 'Catalogue of Carnivorous &c. Mammalia' (1869, p. 95), Himalaya is given as one of the localities for *Vison sibirica* (*Mustela sibirica*, Pall.), and the letters B.M. are appended to show that specimens from the Himalaya are in the British Museum. I am, however, unable to find any such specimens in the collection. In Blyth's 'Catalogue of the Mammalia in the Museum of the Asiatic Society,' too, Himalaya and Tibet are given with a mark of doubt amongst the localities for the same species, but this is due to the mistake of supposing *M. hodgsoni* to be a synonym.

Subfamily MELINÆ.

This subfamily comprises the badgers and their allies. All are furnished with claws adapted for digging, and thus present some resemblance to bears, with which they have been classed by some naturalists. None of the true badgers have been recorded from within Indian limits, although at least one species belonging to the genus has been found in Tibet. Three genera, however, belonging to this subfamily are found in India or Burma, and are distinguished from each other by the following characters:—

A. Upper molar broader than long, not larger than upper sectorial.
  a. An external ear; animal paler below than above .. HELICTIS.
  b. No external ear; animal pale above, black below .. MELLIVORA.
B. Upper molar longer than broad, and larger than upper sectorial.
  a. Bony palate prolonged back to glenoid fossa ...... ARCTONYX.

Genus **HELICTIS**, Gray, 1831.

Syn. *Melogale*, Geoffroy (1834).

Size small. Body and head elongate, the nose prolonged and terminating in a naked, obliquely truncated snout, separated from the upper lip by a narrow hairy space. The nose is naked above for about one third the distance to the eyes. Limbs short. Claws much compressed, fore claws about double the length of the hind. Soles naked; on the hind foot the naked portion terminates some distance in front of the heel. Ears short, but distinct. Mammæ 4.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{1-1}{2-2}$. The upper sectorial, which in both Indian and Burmese forms is much larger than the true molar behind it, has a very large inner lobe divided into two distinct pointed cusps. There is a very small pointed cusp at the anterior extremity of the tooth. The molar is broader than long, the outer margin slightly indented, the crown with several small cusps. The lower sectorial has a heel about one third the length of the tooth.

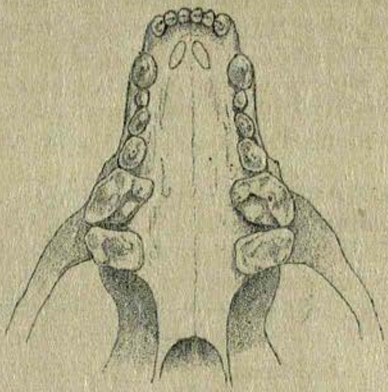

Fig. 43.—Palate of *Helictis personata*.

Skull with the nasal portion narrower than in other genera of the subfamily, and with the palate extending backwards to about halfway between the hindmost molars and the glenoid fossa. Infraorbital foramen large. Vertebræ: C. 7, D. 14, L. 6, S. 4, C?

The species of *Helictis* have longer bodies and shorter limbs than badgers, but are allied to the latter and not to *Gulo* or any other genus of the *Mustelinæ*, so that it is incorrect to call them wolverines, as Jerdon and others have done. Blyth's term Brock-weasel is better, but the animal is not a weasel. All the species are very similar externally, but there are differences in the dentition.

An account of the anatomy of a Chinese species has been given by Garrod (P. Z. S. 1879, p. 305).

Synopsis of Indian and Burmese Species.

A. Colour brown or yellowish brown, not grey.... *H. orientalis*, p. 173.
B. Colour brownish grey .... *H. personata*, p. 174.

87. **Helictis orientalis.** *The brown Ferret-badger.*

Gulo orientalis, *Horsfield, Java*, pl.
Gulo nipalensis, *Hodgs. J. A. S. B.* v, p. 237, vi, p. 560.
Helictis nipalensis, *Gray, P. Z. S.* 1853, p. 191; *Jerdon, Mam.* p. 80.

Oker, Nepalese; *Nyentek*, Malay.

Tail, without the hair, exceeding half the length of the head and body. Fur consisting of soft woolly underfur and longer coarse piles. Teeth of moderate size; outer lobe of the upper sectorial projecting beyond the extremity of the inner lobe in front and behind; anterior cusp of the inner lobe much larger than the posterior.

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Colour. Above dark brown, almost chocolate-brown in general, but some individuals appear rather paler. The underfur is pale brown. A narrow median stripe from the crown of the head to the middle of the back or even to above the hips pure white; also the cheeks and an interrupted band across the forehead, sometimes reduced to a frontal spot. The margin of the ears and terminal third to half of the tail whitish. Lower parts brownish white, sometimes yellowish, the breast and throat paler. Sometimes the pale colour is confined to the middle of the abdomen, the sides being brown.

Dimensions. In a female the head and body measure 16 inches, the tail without hair 7½, with hair 9, hind foot from heel 2¼. A skull measures 2·75 inches in basal length, and 1·75 across the zygomatic arches.

Distribution. The Himalayas in Nepal and Sikhim at moderate elevations, and Java. Other supposed localities probably refer to the next species.

Habits. Very imperfectly known. The animal is nocturnal and lives generally in forests, but wanders into houses, and Anderson says he killed one at night in the house of a Sikhim Bhotia, to the disgust of the proprietor, who declared the creature to be useful in destroying cockroaches and other insects.

I am unable to find any distinction between the Himalayan and Javanese forms distinguished by many authors as *H. nipalensis* and *H. orientalis*. The cranial differences noticed by Gray, Anderson, and others appear to be due to individual variation only.

88. Helictis personata. *The Burmese Ferret-badger.*

Melogale personata, *Geoff. Bélanger, Voy., Zool.* p. 137, pl. v (1834).
Helictis orientalis, *Blyth, J. A. S. B.* xxxi, p. 332, *nec Horsfield.*
Helictis nipalensis, *Blyth, Cat.* p. 70, *Mam. Birds Burma*, p. 29, *nec Hodgson.*
Helictis personata, *Thomas, P. Z. S.* 1886, p. 59.

Kyoung-u-gyi, Burmese (Tickell); *Kyoung-pyan*, Arakanese.

General proportions precisely similar to those of *H. orientalis*. Teeth much larger, and the upper sectorial nearly trapezoidal, the inner lobe being remarkably developed and the two cusps much less unequal than in *H. orientalis*.

Colour. Above brownish grey. In all other respects this form resembles *H. orientalis*; the dorsal underfur is sullied white, dorsal and frontal bands and cheeks white or yellow, lower parts brownish white or yellow. The longer hairs on the sides have whitish tips. Dark portions of the face much darker than the back generally.

Dimensions. Tickell, in his MS. notes, gives for a female:—head and body 15 inches, tail 8½, hind foot 2¼. This I suspect to be small, skulls of this species and stuffed specimens being rather larger than those of *H. orientalis*. The skull of a male measures in basal length 2·85 inches, in breadth 1·87.

Distribution. Recorded from Pegu and Manipur. There is also a skin, apparently of this species, from Cachar, in the British Museum, and in all probability the specimens obtained by Blyth from Tipperah and Arakan are the same.

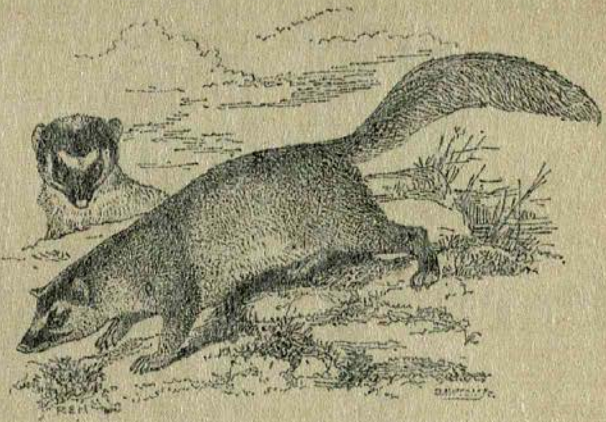

Fig. 44.—*Helictis personata.* (From a drawing by Col. Tickell.)

Habits. This animal is nocturnal like other members of the genus, and appears to be omnivorous. One kept alive by Tickell fed upon fruit, insects, lizards, meat, and eggs, and drank by lapping. It was savage and restless, and appeared well able to defend itself against prowling dogs, as it was kept chained to a tree.

Anderson obtained the Chinese type of the genus, *H. moschata*, distinguished by its very small teeth, in Yunnan, and this species may be found in Upper Burma.

Genus **MELLIVORA**, Storr, 1780.

Syn. *Ursitaxus*, Hodgson (1836).

Body stout. Limbs short, strong; fore claws very large. Tail short. No external ear. Coloration peculiar: the upper parts whitish; lower parts and limbs, with the muzzle, uniformly black. Mammæ 4. Anal glands well developed, one opening on each side of the anus. Feet naked below, on the hind feet the naked sole extends to the heel.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{1-1}{1-1}$. No lower tubercular molar. The upper tubercular (or true) molar much broader than long, thus being transverse and more or less dumbbell-shaped, as in *Mustelinæ*. Upper sectorial large, with the inner tubercle quite at the anterior end. The heel of the lower sectorial very small. Vertebræ: C. 7, D. 14, L. 4, S. 4, C. 15.

The ratels, as they are commonly called in England, have somewhat the form of badgers, but are rather more like bears in gait and appearance. They burrow in the ground, but occasionally climb trees. One species is found throughout Africa, and one in India, but the distinction of the two is somewhat doubtful.

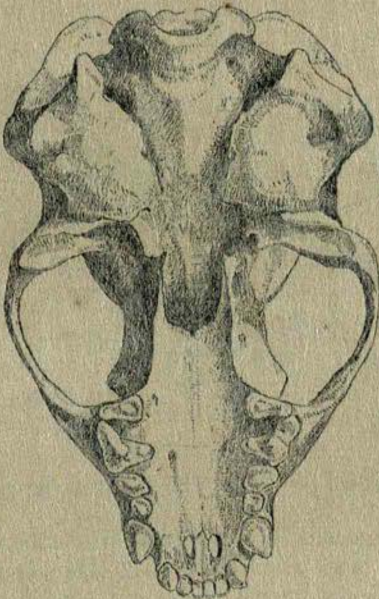

Fig. 45.—Skull of *Mellivora indica.*

Two forms of this genus, *Mellivora sivalensis* and *M. punjabensis*, are found in the Siwalik beds of Northern India, together with a representative of an allied but extinct genus, *Mellivorodon palæindicus.*

89. **Mellivora indica.** *The Indian Ratel.*

Ursus indicus, *Kerr, An. King.* p. 188 (1792).
Mellivora ratel, *Gray, Cat. Mam. Birds Nepal &c. B. M.* p. 13; *Horsf. Cat.* p. 120; *Blyth, Cat.* p. 69.
Mellivora indica, *Jerdon, Mam.* p. 78.
Ursitaxus inauritus, *Hodgson, As. Res.* xix, pt. 1, p. 61; *id. J. A. S. B.* v, p. 671.

Biju, H.; *Gorpat*, Sindhi; *Bájru Bhál*, at Bhagalpur; *Bharsia*, Nipal; *Biyu khawar*, Tel.; *Tava karadi*, Tam.; *Usa banna*, Kol.

Tail without the hair about $\frac{1}{5}$ to $\frac{1}{6}$ the length of the head and body. Fore claws very large, nearly treble the size of the hind claws. No underfur; abdomen very thinly clad.

Colour. Above light grey or whitish grey, lower parts with the limbs black. The dorsal fur consists of longer coarse white hairs mixed with rather shorter and finer hairs which are blackish brown. The whitish upper parts are sharply divided from the black undersurface, and include the crown of the head, though the black area

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covers the ears, eyes, and muzzle; the upper portion of the tail also is whitish except at the extremity. Fore claws white.

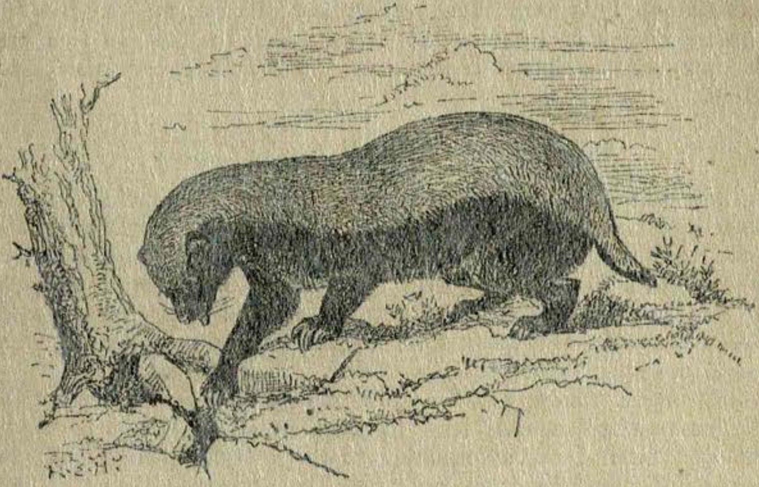

Fig. 46.—*Mellivora indica.*

Dimensions. According to Hodgson head and body 32 inches, tail 5, with the hair 6½, hind foot to heel 4½. Jerdon gives head and body 26 inches, tail 6. A skull is 4·9 inches in basal length by 3·2 in zygomatic breadth.

Distribution. India generally, from the base of the Himalayas to the extreme south, with the exception of the Malabar coast and Lower Bengal. Not found in Ceylon nor to the east of the Bay of Bengal, but the range extends to the westward certainly as far as Sind.

Habits. Like most of its subfamily the Indian ratel is exclusively nocturnal. During the day it remains in holes, probably dug by itself. According to Jerdon it is most common in hilly districts or in those parts of the alluvial plains of Northern India where the rivers have high banks, affording suitable localities for its dens. It is said to live in pairs, to feed on rats, birds, frogs, and insects, and to be very destructive to poultry. Like the African ratel, it doubtless eats honey and bees when it can get them. Throughout India this animal has the reputation of digging into graves of men in order to feed upon dead bodies, and several of the native names mean "gravedigger," a term often applied to the species by Europeans. In Persia the same belief exists with regard to the badger, and is in all probability equally without the least foundation. Indeed, although the dentition of *Mellivora* is more carnivorous than that of the true badgers, the fact that the ratel in confinement lives well on vegetable food renders it probable that this animal feeds partly on vegetables, probably fruit and roots, in the wild state also. At the same time Jerdon states that he has heard of several individuals being trapped whilst committing depredations in fowl-houses, and this is confirmed by McMaster.

Nothing appears to be known of the ratel's breeding-habits. In confinement it is very tame, quiet, and playful, and frequently acquires a habit of tumbling head over heels, for this practice has been noticed in different individuals by Hardwicke, Sterndale, and others.

Genus **ARCTONYX**, F. Cuvier (1825).

Body and limbs stout, tail short. Snout long, mobile, naked towards the end, and truncated, the terminal disk containing the nostrils being much like that of a pig. Ears very short and rounded. Eyes small. Feet naked below, the naked sole not extending to the heel in the hind foot. Claws of all feet much lengthened, those of the fore feet longest, all slightly curved and blunt. Hair coarse and long, with woolly underfur. Mammæ 6.

Infraorbital foramen in the skull very large. Bullæ very small. The bony palate extends back to the glenoid fossæ, and is deeply indented behind in the middle. The posterior portion of the palate is formed by processes from the pterygoid bones. This form of palate is peculiar to *Arctonyx* amongst fissipede Carnivora.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{1-1}{2-2}$. The anterior premolars in both jaws often rudimentary or absent. The upper incisors are arranged in a semicircle. The canines are greatly compressed. Upper sectorial furnished with a large median inner lobe, divided by a transverse groove, but without cusps. Upper tubercular molar much larger than upper sectorial, longer than broad, subtrapezoidal, almost lozenge-shaped, with the heel rounded; this heel becomes worn away in old skulls. Lower sectorial with a large low tuberculated heel. Vertebræ: C. 7, D. 16, L. 4, S. 4, C. 20.

The hog-badgers, as Jerdon very appropriately names them, have a singular resemblance to a pig, owing to the form of the snout. But little is known of their habits. Two forms, one of which is very imperfectly known, are recorded from North-eastern India and Burma.

Synopsis of Indian and Burmese Species.

Large; skull from occiput over 6 inches long...... *A. collaris*, p. 178.
Small; skull from occiput less than 5 inches long.. *A. taxoides*, p. 180.

Some details of the anatomy are described by Dr. G. Evans, J. A. S. B. viii, p. 408.

90. **Arctonyx collaris.** *The Hog-badger.*

Arctonyx collaris, *F. Cuv. Hist. Nat. Mam.* pl. 220 (1825); *Evans, J. A. S. B.* vii, p. 732, pl. xliii; viii, p. 408; *Blyth, Cat.* p. 71; *id. Mam. Birds Burma*, p. 29; *Jerdon, Mam.* p. 77.

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Mydaus collaris, *Gray and Hardwicke, Ill. Ind. Zool.* i, pl. vi.
Arctonyx isonyx, *Hodgson, P. Z. S.* 1856, p. 398, pl. 1.
Meles (Arctonyx) collaris, *Anderson, An. Zool. Res.* p. 196.

Bhála-súr (bear-pig, or according to some *Bála-súr*, sand-pig), H.; *Chomhúvho, Thembakso*, Naga; *Nuloang*, Kuki; *No-ok*, Manipuri; *Quado-Waildu*, Mug; *Khwe-htu-wet-hti*, Arakan; *Khwe-ta-wek-wek-ta-wek*, Burmese.

Tail about a third to a fourth the length of the head and body.

Colour. Dirty grey above and below, slightly washed with blackish above, the hairs being sullied white throughout, except the ends of the longer hairs on the back and sides, which are black. Head white, with the exception of a dark brown or black band from the upper lip over the eye and ear, and of another from the chin, which is dusky, backwards across the cheek, joined by a broader and lighter brown band to the eye and ear-stripe. These head-markings appear variable, sometimes the sides of the head are dark except a white space round the eye. Throat, sides of neck, and tail whitish, lower parts and limbs dusky, the latter sometimes black.

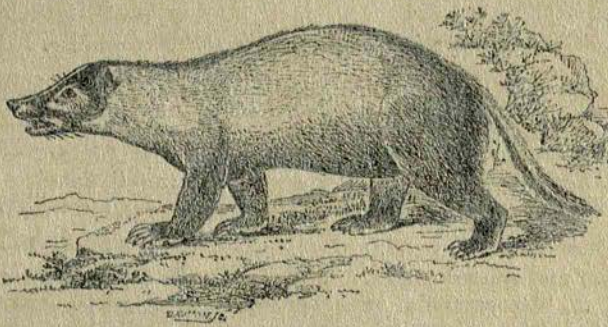

Fig. 47.—*Arctonyx collaris*. (From a drawing by Col. Tickell.)

Dimensions. Head and body of a male 30 inches, tail 9, with hair 11, hind foot $4\frac{3}{5}$ (a Moulmain animal measured by Tickell). An old skull is 5·5 inches in basal length and 3·5 broad.

Distribution. The base of the Eastern Himalayas in Nepal ~~and~~ Sikhim, Assam, Sylhet, Cachar, Arakan, Pegu, and Tenasserim. Anderson obtained this animal in Western Yunnan, but it is not mentioned in Swinhoe's lists of Chinese mammals, nor has it been observed south of Tenasserim. Sterndale says that he heard of it in the forests of Seoni in the Central Provinces; but as he never saw a specimen, it is doubtful if this was the animal of which he obtained information.

Habits. According to Tickell, in his MS. notes, the hog-badger frequents undulating stony ground or small hills amongst jungle, and lives in fissures of the rocks or in holes dug by itself. It is thoroughly nocturnal. In captivity it is dull and uninteresting, feeding voraciously on meats, fish, reptiles, or fruit, and it is particularly fond of earthworms. One individual used to pass the day sleeping in a hole that it had dug and was very savage if disturbed. When angry it made a loud grunting noise and bit fiercely. It was dull of sight, and its only acute sense appeared to be that of smell. It was in the habit of raising its snout in the air in order to scent anyone who approached, much as a pig does. This animal had no disagreeable smell.

Anderson observed an individual, that was kept in the Zoological Gardens of Calcutta, pound plantains to a pulp with its snout before sucking them into its mouth.

McMaster met with this species near Shwe-Gyeng in Pegu, and observed its bear-like gait, which was also noticed by Duvaucel. It is said to support itself easily in an erect position on its hind feet much as bears do.

91. **Arctonyx taxoides.** *The small Hog-badger.*

Arctonyx taxoides, *Blyth, J. A. S. B.* xxii, p. 591 (1853); *id. Cat.* p. 71; *Anderson, An. Zool. Res.* p. 196.
? Meles albogularis, *Blyth, J. A. S. B.* xxii, p. 590.
? Meles leucolæmus, *M.-Edw. An. Sci. Nat.* (5) viii, 1867, p. 374; *id. Recherches Mam.* p. 195, pls. xxiv, xxvi, xxvii, xxviii.
? Arctonyx obscurus, *M.-Edw. Rech. Mam.* p. 338, pls. lviii, lxii.

"Adult about half the size of the adult of *A. collaris*, having a much finer and longer coat, ... the muzzle less broad and hog-like; . . . . the ears also are proportionally smaller; the tail is shorter, and the colour and markings, though similar, are much brighter. Dentition of the upper jaw similar in the two species; in the lower jaw the interspace between the second and third pre-molars is proportionally much greater in *A. collaris* than in *A. taxoides*." (*Blyth, l. c.*)

Dimensions. The skull of a fully adult female measures:—Extreme length (that is, doubtless, from occiput to anterior border of premaxillaries) $4\frac{3}{4}$ inches, breadth across zygomata $2\frac{3}{8}$, length of bony palate $2\frac{3}{4}$, width at posterior great molar (? between hinder molars) $\frac{13}{16}$. The corresponding measurements in an old female of *A. collaris* are $6\frac{1}{8}$, $3\frac{5}{8}$, $3\frac{7}{8}$, and $1\frac{1}{16}$. (*Blyth, l. c.*)

Distribution. Assam and Arakan, perhaps also China. The above details are from Blyth's original description, and are confirmed by Anderson. I have been unable to examine specimens of late. Mr. W. L. Sclater has recently sent to me some additional notes on the dentition of the types of *A. taxoides*. He finds that the last upper premolar is trapezoidal in section, and has no tubercles on the inner side; the corresponding tooth of *A. collaris* is subtriangular in section, and bears one or two inner tubercles.

No true badger of the genus *Meles*, with a bony palate much less produced backwards than in *Arctonyx*, has hitherto been observed within the limits of India or its dependencies; but a species has been recorded from Tibet, north of Nepal and Sikhim, and may occur in Western Tibet also or in parts of the Himalayas. This animal was described by Hodgson as *Taxidea leucura* (J. A. S. B.

xvi, p. 763, pl. xxix). The species is, however, a typical *Meles*, not a *Taxidea*, and very closely allied to the European *M. taxus*, of which it may prove only a variety. It is grey above, the hair long and grizzled, being white at the base, black near the end, and white again at the tips. Lower parts and limbs dusky or black, and a blackish line from the upper lip over the eye. Head and body 27 inches, tail 7, and with hair 10. Skull of a female 4·2 inches long from foramen, 2·65 broad across zygomata.

The other recorded species from Tibet, *M. albogularis*, Blyth, is probably an *Arctonyx*. *Meles taxus* or an allied form may perhaps occur in Southern Afghanistan and Baluchistan.

Subfamily LUTRINÆ.

The otters form the last subdivision of the *Mustelidæ*, and are a well-marked group in which the general musteline type is profoundly modified and the animal adapted for swimming. The feet are strong, short, and rounded, and the toes webbed. The body is very long. The tail is of considerable length, thick at the base, and in general flattened. The head is broad and depressed. The upper posterior molars are large and subquadrate.

Three fossil species of otter have been detected in the Siwalik beds of the Punjab: two of these, *L. palæindica* and *L. bathygnathus*, were not larger than living species; whilst the third, *L. sivalensis*, was the size of a leopard, and had a very different upper sectorial tooth. It was distinguished by Falconer as *Enhydriodon*.

Genus **LUTRA**, Erxleben (1777).

Syn. *Aonyx*, Lesson; *Barangia* &c., Gray.

The feet are in general completely webbed. Soles of the feet naked, the naked sole of the hind foot not extending to the heel. Head long and flat. Ears small. Fur close and short, with woolly underfur.

Skull broad and depressed, with the brain-case large, the facial portion in front of the orbits very short, the frontal region between the orbits and the brain-case long.

Vertebræ: C. 7, D. 14–15, L. 6–5, S. 3, C. 20–26.

Dentition: i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{3-3}$, m. $\frac{1-1}{2-2}$. Anterior upper premolar very small, situated quite inside the canine. Upper sectorial with a trenchant tricuspid blade and a very large inner lobe, having a raised sharp edge and a deep hollow between the edge and the main blade of the tooth. True molar large, subrectangular broader than long.

All otters are very much alike externally, and the determination of the species is consequently in some cases difficult; but the various forms are readily discriminated by their skulls. Dr. Anderson has, I think, succeeded in clearing up much of the confusion in which the Indian species had been left by Gray and others.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Claws distinct and well developed on all toes.
  a. Head and body more than 2 feet long in adults.
    a. Upper margin of naked nose angulate in middle; dorsal fur generally grizzled . . *L. vulgaris*, p. 182.
    b. Upper margin of naked nose straight; dorsal fur not grizzled . . . . *L. ellioti*, p. 185.
  b. Head and body 20–22 inches . . . . *L. aureobrunnea*, p. 186.
B. Claws small and rudimentary; size small. . . . *L. leptonyx*, p. 187.

92. **Lutra vulgaris.** *The common Otter.*

Lutra vulgaris, *Erxleben, Syst. Reg. An.* p. 448 (1777); *Blyth, Cat.* p. 73; *Jerdon, Mam.* p. 88, *partim*; *Scully, P. Z. S.* 1881, p. 203.
Lutra nair, *F. Cuv. Dict. Sc. Nat.* xxvii, p. 247 (1823); *Elliot, Madr. Journ. L. S.* x, p. 100; *Blyth, Cat.* p. 72, *partim*; *Jerdon, Mam.* p. 86, *partim*; *Anderson, An. Zool. Res.* pp. 206 &c., pl. xi (skull); *Kelaart, Prod.* p. 35.
Lutra indica, *Gray, Charlesworth's Mag. N. H.* i, p. 580 (1837).
? Lutra taraiyensis, *Hodgson, J. A. S. B.* viii, p. 319 (1839).

Ud, Ud biláo, Páni kutta, H.; *Sag-i-áb*, P.; *Lad, Pán-manjar, Jal-manjar, Jal-mánus*, Mahr.; *Nirunai*, Tam.; *Niru-Kuka*, Tel.; *Nirnai*, Can., Mal.; *Dalwai bek*, Wadári.

The upper edge of the naked muzzle where the hairy part of the nose begins is not straight, but projects in the middle and is concave on each side, running up considerably to the hinder edge of the nostril on each side.

Skull (fig. 48) much depressed and elongate, the length being nearly double the breadth of the brain-case. The frontal region of the skull behind the postoccipital processes narrows gradually for some distance, then expands to form the brain-case. Teeth of moderate size, the rounded inner lobe of the upper sectorial about two thirds the length of the tooth; length of upper sectorial along its outer margin not exceeding the breadth of the six upper incisors taken together.

Colour. Above hair-brown, with a more or less rufous tinge; woolly underfur at the base white, then brown, the tips of the longer hairs usually paler, producing in most Indian specimens a grizzled appearance, which is very characteristic. Lower parts (including the base of the tail below, abdomen, breast, and inside of limbs, throat, chin, and sides of head and neck below the ears) whitish; fur of the chin and throat white throughout, of the other parts white at the base, then light brown, and the tips white. These white tips are much more distinct in old specimens, in which

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the colours of the upper and under surfaces are well defined. The young is dusky brown above, paler below, with the two colours less distinct.

Dimensions. Head and body 25 to 29 inches, tail 15 to 16; weight about 16 to 20 lbs., sometimes more. (The measurements given of this animal in India are inextricably mixed up with those of the next species.) A Calcutta skull of an old male measures in basal length 4·25 inches, zygomatic breadth 2·7, height from between bullæ 1·35 (in another 1·5). The corresponding measurements of a female skull are 4, 2·55, and 1·3 inches.

Distribution. The common otter is found throughout the Palæarctic region, extending into the North-west Himalayas; and the Indian form, usually known as *L. nair*, appears to inhabit nearly the whole of India and Ceylon, and to occur east of the Bay of Bengal. Owing to the circumstance that the next species, *L. ellioti*, has only lately been clearly distinguished, the relative distribution of the two cannot be precisely ascertained.

Varieties and Synonymy. Although I can find no constant characters by which to distinguish the Indian otter, *L. nair*, from the European otter, *L. vulgaris*, I cannot help suspecting that they may be distinct. As a rule, *L. vulgaris* appears to be larger, the fur is more rufous and but rarely grizzled. The skull is larger, the brain-case broader, and the upper sectorial and molar proportionally smaller and shorter. Generally the anterior point of the upper sectorial is nearer to the hinder edge of the molar than to the anterior border of the canine. The reverse is the case in *L. nair*. But on examining a considerable series I find not one of these characters constant, and the skulls, as well as the skins, appear to me in some cases undistinguishable.

The type of *L. nair* came from Pondicherry; that of *L. indica* was also from Southern India, and was collected by Sir W. Elliot.

Anderson (*l. c.* p. 207) has pointed out how difficult it is to identify Hodgson's species, as the types were forwarded to the British Museum without the names being attached, and the skulls were received separately without any indication of the skins to which they respectively belonged. The skins now marked *L. tarayensis* in the Collection belong to the next species, but Hodgson's description must, I think, apply to the present.

Habits. Otters inhabit rivers chiefly, but are occasionally found in India in large tanks, and they are common in the great backwaters of the Western Coast, and in the Chilka Lake of Orissa. They also occur in salt-water inlets and tidal streams, and occasionally enter the sea. They are usually seen in India in parties of five, six, or more, consisting probably of a pair of old animals and their full-grown or nearly full-grown offspring. These live together in a den, usually amongst rocks, or, in alluvial countries, in an extensive burrow with several entrances on an elevated spot close to the water. One entrance to the den is generally under the water. The presence of otters, wherever they inhabit, is easily recognized by their peculiar web-footed tracks on the sand or mud.

To a considerable extent otters are nocturnal, but in wild countries they are by no means exclusively so. I have repeatedly seen them hunting in rivers up to 9 or 10 o'clock in the morning and again in the afternoon long before sunset. They live chiefly upon fish, crustacea, and frogs, and, as is well known, when they find food plentiful, kill far more than they require to eat. They are said occasionally to attack waterfowl, and to eat the eggs of birds, and in all probability they are, if hungry, not particular; I once came upon a party that were pulling about a small crocodile, but I cannot say whether they had killed it. Their movements in the water are exceedingly rapid and graceful, and they can run with considerable speed on land. In fishing, otters act in concert and surround or drive a shoal of fish. Colonel McMaster, in his 'Notes on Jerdon,' describes an instance in which he saw this done in the Chilka Lake. The otters, at least six in number, swam out in a semicircle, with an interval of about fifty yards between each two. "Every now and then an otter would disappear, and generally when it was seen again it was well within the semicircle with a fish in its jaws, caught more for pleasure than for profit," as the fish were always left untouched after a single bite.

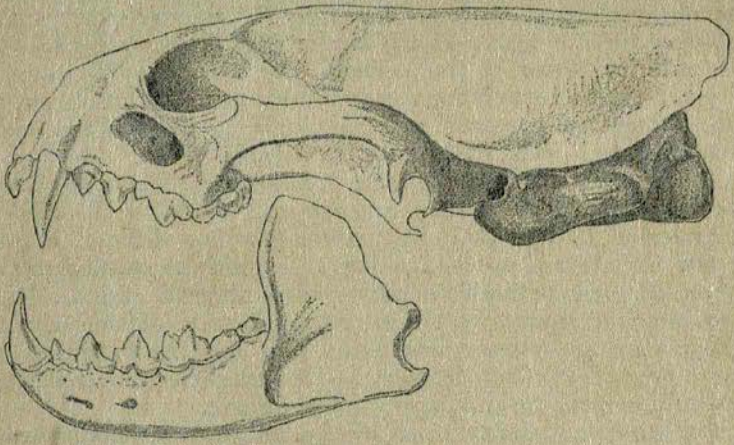

Fig. 48.—Skull of *Lutra vulgaris*. (*L. nair*, Anderson, An. Zool. Res.)

The hearing and sense of smell in otters are well developed; but I am inclined to think them not very sharp of sight. They are very intelligent and cunning. Their usual cry is a sharp yelp, which they utter when excited or surprised. They are also said to make a whistling sound as a note of alarm.

I cannot find anything recorded about the breeding of otters in India. In Europe they have frequently bred in confinement (P. Z. S. 1881, p. 249). They sometimes, at all events, pair in the water. There appears to be no particular season for breeding, but the young are generally born in the winter, and the same is probably the case in India. The period of gestation is about sixty-one to sixty-three days, the number of young usually from two to five; these are blind for some time after birth.

Otters are easily tamed when captured young, and become very much attached to their masters, whom they will follow like a dog. They are kept tame by fishermen in several parts of India, especially in Jessore, the Bengal Sunderbans, and on the Indus, and are employed to drive the fish into nets, not, as in China, to actually capture fish for their masters.

93. **Lutra ellioti.** *The smooth Indian Otter.*

Lutra monticola, *Hodgson, J. A. S. B.* viii, p. 320 (1839); *Anderson, An. Zool. Res.* p. 207, pl. xii, figs. 1–3 (skull).
Lutra taraiyensis, *Blyth, J. A. S. B.* xi, p. 99, *nec Hodgson.*
? Lutra simung, *Horsfield, Cat.* p. 116.
Lutra nair, *Cantor, J. A. S. B.* xv, p. 195; *Blyth, Cat.* p. 72, *partim*; *id. Mam. Birds Burma,* p. 28, *nec Cuv.*
Lutra ellioti, *Anderson, An. Zool. Res.* p. 212.

Ludra, Sindhi; *Hpyan,* Burm.; *Phey,* Talain; *Bong,* Karen; *Mamrang, Amrang, Anjing-ayer,* Malay.

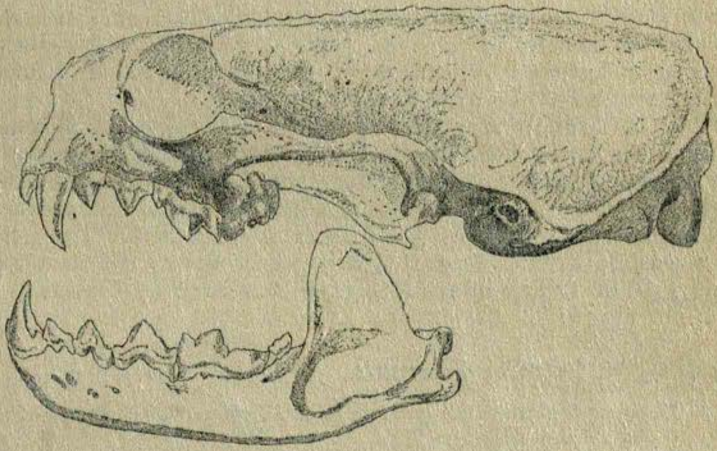

Fig. 49.—Skull of *Lutra ellioti.* (*L. monticola,* Anderson, An. Zool. Res.)

The upper border of the naked muzzle is nearly straight from end to end. Fur smooth and short.

Skull elongate, but much less depressed than that of *L. vulgaris.* Frontal region of skull with the sides parallel for some distance behind the postorbital processes, and then suddenly constricted, so that there is the appearance of a postorbital swelling.

Molar teeth large; the inner lobe of the upper sectorial very large, more than half the breadth of the tooth, and exceeding two thirds the length. The length of the upper sectorial along the outer edge exceeds the breadth of the six upper incisors taken together.

Colour. Very uniform hair-brown above, with a slight greyish tinge, and without any trace of grizzled appearance. Some specimens are more rufous. Underfur pale brown. Lower parts lighter brown; the breast, throat, chin, and sides of head and neck whitish or white. In some specimens, probably old, the tips of the hair on the abdomen are white.

Dimensions. Rather less than those of *L. vulgaris.* A large skull, probably male, measures 4·7 inches in basal length, 3·2 in breadth, and 1·8 in height from between the bullæ. A female skull is 4·36 inches long, 2·9 broad, and 1·7 high, similarly measured. I learn from Mr. Scully that this otter is shorter than *L. vulgaris*, though more robustly built, with a much larger skull. No trustworthy measurements are available.

Distribution. Apparently throughout India, from the Lower Himalayas. Common in the Indus, in Sind, also in Lower Bengal, Burma, and the Malay Peninsula.

Synonymy. This is, I think, probably the *L. monticola* of Hodgson, and there are several specimens in his collections; but as the species is not a hill-otter the name is misleading, and must be abandoned. *L. simung* of Horsfield is founded on a skin without a skull from Sumatra, and, though probably referable to this species, the identification is uncertain. I consequently, at Mr. Scully's suggestion, adopt the name *L. ellioti.*

Habits. Probably very similar to those of *L. vulgaris.* Whether this is the species kept tame by the Mohánas of Sind and employed by them in fishing, and in capturing porpoises as described by Hume ('Stray Feathers,' i, p. 110), I am doubtful; the tame otter appeared to Hume, as it subsequently did to me, a small kind. There can, however, be little doubt that this is one of the species kept tame and used for fishing by the Malays, as mentioned by Cantor.

94. **Lutra aureobrunnea.** *The Himalayan Otter.*

Lutra aurobrunnea, *Hodgson, J. A. S. B.* viii, p. 320; *Anderson, An. Zool. Res.* p. 212.
? Barangia nepalensis, *Gray, P. Z. S.* 1865, p. 124.

"Habit of body still more vermiform (than in *L. indigitata* = *leptonyx*). Tail less than ⅔ of the body. Toes and nails fully developed. Fur longish and rough. Colour rich chestnut-brown above, golden red below and on the extremities. Length of head and body 20 to 22 inches, tail 12 to 13; weight 9 to 11 lbs."

The above description is quoted from Hodgson. No other naturalist has met with this otter; but there is good evidence in Hodgson's collections at the British Museum that at least one species, besides *L. vulgaris*, *L. ellioti*, and *L. leptonyx*, is found in Nepal.

There is in the first place the skull to which Dr. Gray gave the name of *Barangia nepalensis*. *Barangia* was a genus founded on the hairy-nosed Malay otter (*Lutra sumatrana*). The Nepal skull is imperfect behind, but would, if perfect, probably be about 4 inches long. The zygomatic breadth is 2·45. The teeth are small. There is much resemblance to the skull of *L. sumatrana*, but the hinder upper molar is differently shaped, the inner lobe having the same antero-posterior length as the outer. In the Malay species the inner lobe is smaller. This skull is perfectly distinct from those of all known Indian otters.

There is also a flat skin of an otter, rich dark brown throughout, slightly paler and with a golden tinge below. The fur is thick and woolly and somewhat harsh. Both texture and colour may be due to some preservative process. The skin is stretched and distorted, having evidently been hung up by the nose to dry, and it is impossible to say whether the nose was hairy or not. This may be the dyed skin of a young *L. vulgaris*, or it may, as Anderson has suggested, belong to the same animal as the skull already mentioned. The circumstance that only one of each exists in the collection is in favour of the latter view.

Hodgson, as quoted above, gives varying measurements and weights, and from this it might be inferred that he examined more than one individual. I can find no information about the animal in his MS. notes.

It is very probable that *L. sumatrana*, the hairy-nosed Malay otter (*L. barang* of Cantor, though not, as Anderson has shown, *l. c.* p. 204, of F. Cuvier), may extend its range into Tenasserim and even further north. This species and its skull are figured by Anderson (*l. c.* pls. x, xii). It is a large otter, the length of the head and body in an old male, according to Cantor, being 32½ inches, tail 20, and the colour is deep rich brown throughout, except on the chin and throat, which are whitish. The nose is entirely hairy in young specimens, but in older individuals the hairs become partially worn off. That a third species, besides *L. ellioti* and *L. leptonyx*, is found in Pegu is suggested in Col. McMaster's notes.

95. **Lutra leptonyx.** *The clawless Otter.*

Lutra leptonyx, *Horsfield, Res. Java* (with figure); *Blyth, Cat.* p. 73; *Jerdon, Mam.* p. 89.

Lutra indigitata, *Hodgson, J. A. S. B.* viii, p. 320.

Aonyx leptonyx, *Cantor, J. A. S. B.* xv, p. 195; *Horsfield, Cat.* p. 117; *Blyth, Mam. Birds Burma*, p. 28.

Chusam, Bhot.; *Suriam*, Lepcha; *Anjing-ayer*, Malay.

Tail about half the length of the head and body. Head short,

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rounded. Claws extremely small and rudimentary, and sometimes wanting altogether; the third and fourth toes on all feet considerably longer than the other toes.

Skull much shorter than in other Indian forms, the length being but little more than one and a half times the breadth of the braincase, which is very broad. The inner lobe of the upper sectorial large. The upper (last) molar much larger in proportion to the breadth than in other species.

Colour. Moderately deep brown, with a more or less rufous tinge above, paler below; sometimes the difference is very slight, except on the cheeks and upper lip, with the sides of the neck, chin, and throat, which are whitish or white; this colour is sharply divided from the brown on the sides of the head and neck, but passes gradually into the paler brown of the breast. The underfur of the back is lighter in colour near the base.

Dimensions. Head and body 22 to 24 inches, tail 10½ to 13, hind foot 3½; weight 11 to 13 lbs. A skull measures 3 inches in basal length and 2·25 wide across the zygomatic arches; another 3·1 by 2·4.

Distribution. The clawless otter is found throughout the greater part of the Oriental region. It inhabits the Himalaya generally at low elevations, is found in Lower Bengal, being common near Calcutta, in Assam, Burma, Southern China, the Malay Peninsula, and several of the islands, including Java. Beyond Lower Bengal this species has not been recorded from the peninsula of India, except at considerable elevations on the Nilgiri and some other ranges in the Madras Presidency; but a small otter said by Kelaart to inhabit the neighbourhood of Newera Ellia, in Ceylon, is very possibly *L. leptonyx.*

Habits. Similar, so far as is known, to those of other otters. This animal is said by Cantor to be kept tame and employed by fishermen in Malacca, together with other species.

By many writers the small clawless otter, *Lutra leptonyx*, is separated from other Indian otters and classed in a distinct genus, *Aonyx*, the type of which is the Cape otter, *L. inunguis*. This is distinguished by having the merest rudiments of claws and the toes half-webbed. *L. leptonyx* also has very small claws, though not quite so rudimentary as those of *L. inunguis*, but the toes are as fully webbed as those of most otters. Although it does not differ from *Lutra* in the same manner as the type of *Aonyx* does, *L. leptonyx* has several peculiarities of its own not shown by its supposed ally. Its skull is peculiarly short and broad, with a differently shaped upper posterior molar, and its feet differ from those of other species, including *L. inunguis*, in the much greater proportional length of the third and fourth toes.

The most remarkable peculiarity of *L. leptonyx*, the form of the skull, is repeated in a South-American species of otter, *L. felina*.

Family PROCYONIDÆ.

In the classification hitherto followed, that of Professor Flower, the Himalayan genus *Ælurus* is made into a separate family; but the differences from the American *Procyonidæ*, comprising the racoons (*Procyon*), kinkajou (*Cercoleptes*), and their allies, do not appear sufficient to justify the separation. Hodgson pointed out several characters in which *Ælurus* agrees with the *Procyonidæ*, and others have been recorded by Flower. Blyth, in his Catalogue, placed the genus between *Cercoleptes* and *Procyon*, and the only distinctions especially mentioned by Flower are the presence in *Ælurus* of an alisphenoid canal which is wanting in the American types, and the Asiatic habitat of the former genus. The case of *Viverricula* already mentioned shows that the presence of an alisphenoid canal is not necessarily a character of importance, whilst to admit geographical distribution as a reason for distinguishing biological groups appears a mistake, and liable to cause incorrect ideas as to natural affinities and the relations of faunas in different regions. I feel even doubtful whether a separate subfamily is required for the Asiatic representative of the *Procyonidæ*.

The members of this family are distinguished by having two true molars on each side, both in the upper and lower jaw.

Genus **ÆLURUS**, F. Cuvier (1825).

This genus contains but a single species peculiar to the Himalayan region.

The head is round, the face short and broad, the eyes directed forward, the pupil round, the ears well developed; the limbs stout, plantigrade, densely covered with hair below; the claws large, curved, sharp, and semiretractile. Tail long. Mammæ 8. Vertebræ: C. 7, D. 14–15, L. 6–5, S. 3, C. 18.

Skull high and compressed. The zygomatic arches very strong and much curved upwards. The coronoid process of the mandible remarkably high, and the distance from the condyle to the angle also unusually great, with the result that the ascending ramus of the lower jaw is singularly developed.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{4-4}$, m. $\frac{2-2}{2-2}$. The canines are much compressed. The molar teeth are very peculiar (see figure), and differ widely from those of all other Asiatic Carnivora. They are very broad, and the crowns are covered with numerous pointed cusps; these, when worn down, produce a pattern resembling that on the molars of some Ungulates. The upper sectorial is smaller than the first true molar, and semioval in shape, the inner lobe very broad and furnished with three cusps, arranged in a triangle, the inner smaller than the others. The second premolar is very similar to the third or sectorial in shape, and like it has a third root supporting the inner lobe. The first lower premolar is small and deciduous. There is much resemblance between the dentition of *Ælurus* and that of *Procyon*, though the latter has not the remarkable second upper premolar of the former.

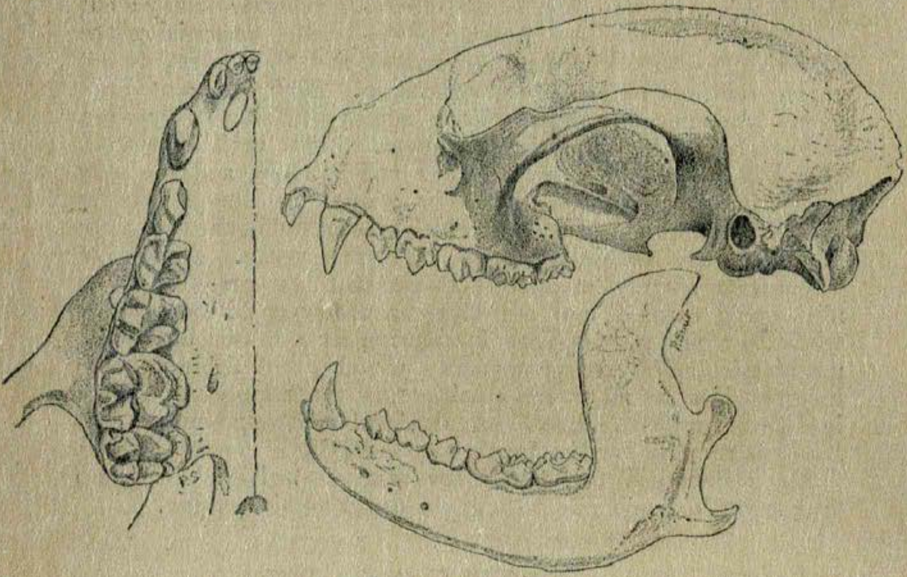

Fig. 50.—Half palate and skull of *Ælurus fulgens.*

The anatomy is described by Hodgson, J. A. S. B. xvi, pp. 1119, 1124, &c., and xvii, pt. 2, pp. 475, 573, and by Flower, P. Z. S. 1870, p. 752. Several important additions are made in the latter paper, and especially the presence of anal glands, which Hodgson thought were wanting, was demonstrated.

96. **Ælurus fulgens.** *The red Cat-bear or Himalayan Racoon.*

Ailurus fulgens, *F. Cuv. Hist. Nat. Mam.* pl. 203 (1825); *Horsf. Cat.* p. 126; *Jerdon, Mam.* p. 74; *Sclater, P. Z. S.* 1869, p. 408; *Simpson, P. Z. S.* 1869, p. 507, pl. xli.
Ailurus ochraceus, *Hodgson, J. A. S. B.* xvi, p. 1118, pls. lii, liii; xvii, pt. 2, pp. 475, 573.
Ælurus fulgens, *Flower, P. Z. S.* 1870, p. 752; *Bartlett, ibid.* p. 769.

Wah, Yé, Nigálya-ponya, Nepal; *Thokya, Thongwa*, Limbu; *Wakdonka, Woker*, Bhotia; *Sankam* (or *Saknam*?), Lepcha.

Tail about two thirds the length of the head and body, or rather more. Fur long and thick, with woolly underfur. Feet and toe-pads completely concealed by hair.

Colour. Back, head above, and tail rusty red, varying in tint, the middle of the back frequently paler, the forehead always lighter in

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colour, and several pale rings on the tail, the tip of which is black. Limbs inside and lower parts black, often brownish on the abdomen; soles of feet light brown or whitish. Underfur throughout the body hair-brown. Face and lower lips white, with the exception of a vertical stripe of red from just above the eye to the gape; the ears too are white inside and near the edge outside, remainder of outside surface of ears dark red or black; the hair is red also below the ears behind the white cheek-patches. Claws white.

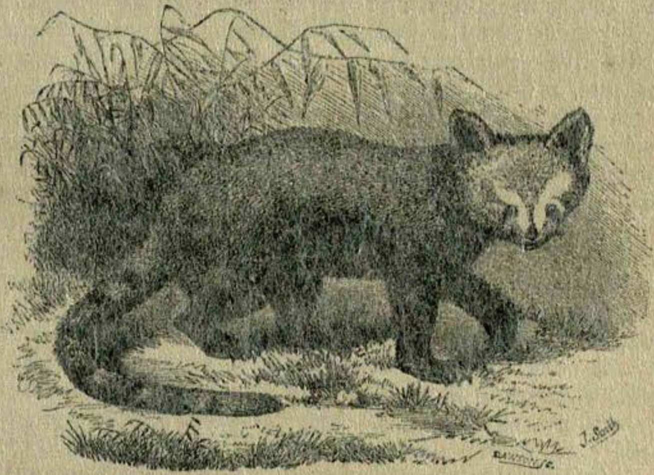

Fig. 51.—*Ælurus fulgens.* (P. Z. S. 1869, p. 408.) The dark nose-stripe here represented is generally wanting, and the face is white throughout.

Dimensions. A large male measured: head and body 24 inches, tail 17, or with hair at the end 19½; other specimens measured: head and body 20 to 22 inches, tail 16, or with hair 18, the hind foot from the heel 4¼. Weight 7 to 9½ lbs. A large skull is 3·65 inches in basal length, and 3·05 broad across the zygomatic arches.

Distribution. South-eastern Himalayas, from about 7000 to about 12,000 feet elevation. This animal has not been found west of Nepal, but it ranges eastward throughout the mountains north of Assam to Yunnan (Anderson, An. Zool. Res. Introduction, p. xx).

Habits. Hodgson has given a very full account of these, and some useful additions have been made by Dr. Simpson and Mr. Bartlett.

The present animal inhabits forests, and lives in holes of trees, or perhaps amongst rocks. It, however, feeds much on the ground. As a rule it is found in pairs or small families. Its food is almost entirely vegetable, consisting of fruits, acorns, sprouts of bamboo (whence the name Nigálya-ponya), grass, roots, &c. It also eats eggs, and, according to Jerdon, insects and larvæ, though Hodgson says that the individuals kept by him refused similar food (perhaps he did not try the proper kinds). Hodgson also states that it is

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fond of milk. All observers, however, agree that it either refuses flesh of all kinds, or takes it very reluctantly. Hodgson tried repeatedly the experiment of putting a live fowl in the cage of an *Ælurus*, which but rarely killed the fowl, and never ate it.

The sharp and powerful semiretractile claws of *Ælurus* are thus manifestly not used for predatory purposes, but are admirably adapted for climbing; and there can be no question that this form, like so many of the Himalayan mammalia, is chiefly arboreal in its habits. It is dull of sight and hearing, and even its sense of smell is not very acute; and, according to Hodgson, it is easily captured, having but little speed, cunning, or ferocity to protect it. It grasps articles, such as fruit, readily with its paws, as observed by Bartlett. Its walk is plantigrade; its movements on the ground slow and awkward. It sleeps sometimes coiled up like a cat or dog, with the bushy tail over the head, sometimes resting on its legs with the head tucked under the chest and between the fore legs, a practice common, it is said, with American racoons, and doubtless due to the habit of resting on a branch of a tree. Bartlett especially notices the resemblance between its habits generally and those of the kinkajou (*Cercoleptes*).

Though by no means distinctly nocturnal, *Æ. fulgens* sleeps much in the day, moving about and feeding in the morning and evening. According to Bartlett it drinks like a bear, by inserting its lips, and not by lapping, though Hodgson says the contrary. Its usual cry, or call-note, is a short faint squeak, said by Dr. Simpson to resemble the chirping of a bird; but when angry it rises on its hind legs like a bear, and attacks with what one observer terms a series of "snorts," and another a "sharp spitting hiss." Jerdon says that a friend of his watched a pair seated high up on a lofty tree, and making most unearthly cries, evidently at the pairing-season.

The period of gestation is not known, but the young are generally two in number, and are produced in spring. They appear to have a long period of helplessness, during which they remain in their place of birth, a hollow tree or hole among rocks, and they remain with the parents until another brood is about to appear.

As a rule these animals appear to be easily tamed even when adult. They are delicate animals, and cannot endure heat, and they also suffer from much cold. When excited, according to Dr. Simpson, a male had the power of emitting a strong odour of musk.

Family URSIDÆ.

The last family of the Arctoidea contains the bears, a very natural group, all of them animals of considerable size, heavily built, thoroughly plantigrade, and with the feet adapted for digging, though not used for fossorial purposes in the same manner as those

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of badgers, no bears being known to live in holes dug by themselves.

In this family there are two true molars in the upper and three in the lower jaw, all having broad, flat, tuberculated crowns. The upper sectorial differs from that of other Carnivora in wanting the inner root; the tooth has a small posterior inner lobe without a distinct fang, and looks much like a small true molar. The upper molars are all in one line, the last having its longer axis not transverse, but in the same direction as that of the others. The auditory bulla is very little inflated, its lower surface being almost flat.

Much difference of opinion exists as to the generic subdivisions of the family, but most naturalists place the common Indian bear, or sloth-bear, in a distinct genus from true *Ursus*. The two genera found within Indian limits are thus distinguished:—

Six incisors in the upper jaw	URSUS.
Four incisors in the upper jaw..................	MELURSUS.

Bears are found throughout the Palæarctic, Oriental, and Nearctic regions, and one species occurs on the Andes in South America; none are known to inhabit Africa south of the Atlas, or Australia.

The remains of one species of bear, *Ursus namadicus*, have been found in the Pleistocene Nerbudda beds of Central India; the species was probably allied to *U. malayanus*. Another form, *U. theobaldi*, of which a skull has been met with in the Pliocene Siwaliks, may have been an ancestral type of *Melursus ursinus*. Besides these traces of three species belonging to the extinct ursine genus *Hyænarctus* occur in the Siwalik beds.

Genus **URSUS**, Linn. (1766).

Syn. *Helarctos*, Horsfield (1825).

The feet are broad and completely plantigrade, with the soles naked; the five toes of each foot all well developed and armed with long, compressed, and moderately curved, non-retractile claws. Tail very short. Ears small, erect, rounded, hairy. Pupil round. Mammæ 6.

Vertebræ: C. 7, D. 14, L. 6, S. 5, C. 8–10. Skull elongate (except in *U. malayanus*); orbits small and incomplete behind; palate prolonged considerably behind last molars. An alisphenoid canal present. There is a marked projection inside the base of the lower jaw near the angle, as in seals.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{2-2}{3-3}$. The three anterior premolars above and below are small, one-rooted, and frequently wanting; the second especially, in both jaws, being generally lost in adult skulls. The upper sectorial is considerably smaller than either of the true molars, which are both longer than broad, with flattened, tuberculated grinding-surfaces, much worn down in old animals. The second is much the larger, and has a large backward prolongation or heel. In the lower jaw the first premolar is

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larger and more persistent than the second and third; the lower sectorial has a small and indistinct blade and greatly developed tubercular heel. The second true molar is about the same length as the lower sectorial, but broader, the hindmost molar is shorter.

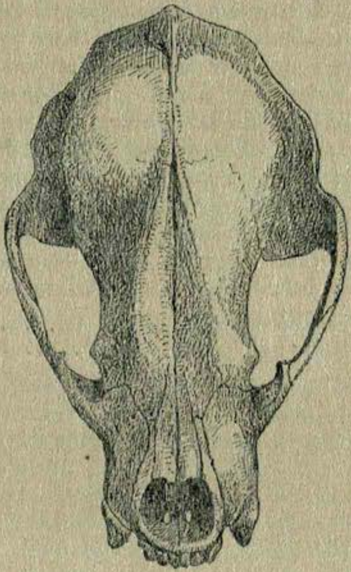

Fig. 52.—Skull of *Ursus malayanus*, young.
(In older animals the breadth is proportionally much greater.)

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Colour brown; claws brown or white...... *U. arctus*, p. 194.
B. Colour black.
  a. Larger: length over 5 feet; ears 5 to 6 inches long; claws black .... *U. torquatus*, p. 197.
  b. Smaller: length under 4 feet 6 inches; ears about 2 inches long; claws pale .. *U. malayanus*, p. 199.

97. **Ursus arctus.** *The brown Bear.*

Ursus arctos, *L. Syst. Nat.* ed. 12, i, p. 69 (1766).
Ursus isabellinus, *Horsf. Linn. Trans.* xv, p. 332 (1827); *Adams, P. Z. S.* 1858, p. 517; *Blyth, Cat.* p. 76; *Jerdon, Mam.* p. 69; *Lydekker, J. A. S. B.* xlvi, pt. 2, p. 285; *Scully, P. Z. S.* 1881, p. 203.
? Ursus pruinosus, *Blyth, J. A. S. B.* xxii, p. 589; *W. Blanf. J. A. S. B.* xlvi, pt. 2, p. 318.

Barf-ka-rinch, *Lál-bhálú*, H.; *Háput*, Kashmiri; *Drengmo*, Balti; *Drin-mor*, Ladak; *Brabu*, Kishtwar; *Dúb*, Nepal; *Tom-khaina*, Tibetan; *Snow bear* of European sportsmen.

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Size large. Claws moderate. Fur long in winter, thick, shaggy, and soft, with woolly underfur, the hair on the back being as much as 8 inches in length; in summer the fur is shorter, thinner and darker. Ears of moderate size, covered with long hair.

Colour. Various shades of brown, from very pale to dark brown, some animals silvery grey from the fur having white tips, some are reddish brown. In the Eastern Tibetan form (*U. pruinosus*) the hair on the back and limbs is blackish with pale tawny tips. The fur is rather paler and greyer at the base. According to Kinloch, as a rule in Kashmir old males are the darkest, young animals and females paler, but there are exceptions. In young animals there is a white half-collar on the breast, and this mark is conspicuous in older individuals on the new fur, when the long winter coat has recently been shed. Claws generally in Himalayan animals pale or white.

Dimensions rather variable, as in all bears, males being larger than females. The Himalayan race (*U. isabellinus*) appears, judging from skulls, to run rather smaller than the European brown bear. Scully gives the length in Gilgit as from 4 feet 8 inches to 5 feet 8; according to Kinloch a very large bear would measure about 7 feet from snout to tail, the latter being only two or three inches long; whilst Adams says the largest he measured, out of hundreds, was 7 feet 6 inches long, and 3 feet 5 inches high. A moderate-sized skull is 11·7 inches long in basal length, and 7·25 broad across the zygomata. The largest skull in the Calcutta Museum measures 12·5 inches by 8·8, a large European skull 13 by 9·5.

Distribution. Throughout the greater portion of the Palæarctic region. The brown bear inhabits the Himalaya from Afghanistan as far east as Nepal, at all events, and is, or was, common in Kashmir and many parts of the N.W. Himalaya, but it does not occur in Ladák, Suru, Zanskár, or any of the districts north of the main range, though common further west in Astor and Gilgit. *U. pruinosus* is found in the neighbourhood of Lhassa.

Synonymy. I can find no sufficient reason for distinguishing *U. isabellinus* from *U. arctus.* Both vary in colour, and are often of the same tint, the Himalayan form, like the Syrian, being as a rule paler than the European, perhaps because the two Asiatic varieties inhabit more open ground. The difference in size does not appear sufficiently great or constant to justify distinction.

Habits. In summer the Himalayan brown bear keeps to high elevations, living chiefly on the grass slopes above the forests, close to the snow; in autumn and spring he is found at lower levels, frequently entering the forests, and descending to the neighbourhood of villages to feed on fruit or grain. In winter these bears retreat to caves, and hybernate or remain in a torpid condition until spring. Their winter retreats are usually, at that season, buried beneath the snow. They reappear about March or April, and in those months and May may be found on open spots on the hill-side, where the snow has melted, feeding on the young sprouts

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of grass and herbs, digging for roots and turning over stones to search for insects. Grass, herbs, and roots form their principal food, with the addition of various fruits and seeds found in the forest, or plundered from the neighbourhood of villages. They are fond of apricots, peaches, apples, mulberries, walnuts, and buckwheat, to obtain which they descend into the valleys occasionally when the fruits are ripe, soon returning, however, to the higher slopes near the snow. Sometimes they are said to kill sheep or goats, and they have been known to feed on the flesh of animals they had killed or found dead. Dr. J. L. Stewart (P. A. S. B. 1867, p. 175) records an instance of a large brown bear killing two smaller bears in succession, and eating portions of their bodies. In Europe the brown bear frequently kills and eats animals, it is said even cattle and ponies; but this may be due to vegetable food being less abundant than on the Himalayas, where the brown bear, as a rule, by general testimony is not carnivorous.

Bears are dull of sight and hearing, and although they possess good powers of smell, they appear inferior, even in this respect, to many animals. They can move pretty quickly in a clumsy gallop, but their usual pace is slow. They can climb trees, but in the Himalayas, at all event, rarely do so. The Himalayan brown bear is a very harmless animal, never attacking men, and very rarely, if ever, showing fight even when wounded.

The Himalayan brown bears pair at the end of September, in October and November, and at that time males and females are found together. They, however, go into separate winter-quarters. The young, usually two in number (one with young females), are born in April or May, the period of gestation being about 6 months. Young bears, when born, are very small, scarcely larger than a good-sized rat; they are born hairless and blind, and remain without sight for four weeks; when they are three or four months old they accompany the mother in her rambles. Cubs of two different years are often found with the mother at the same time; all remain with her, as a rule, until nearly three years old, at which time they are full-grown. In Russia it is asserted that a male cub of the previous year takes charge of the young belonging to the next litter, and acts as a kind of nurse; but this may be one of the endless folk-lore stories that have accumulated about bears, as about other formidable Carnivora.

One of these stories is to the effect that bears, when attacking, hug those whom they assail, and squeeze them to death. A "bear's hug" is proverbial. The story is apparently without foundation. A bear, from its anatomical structure, strikes round with its paws, as if grasping, and the blow of its powerful arm drives its claws into the body of its victim, causing terrible wounds, but the idea of its "hugging" appears not confirmed by recent observers.

Bears are easily tamed, and it is not uncommon to see examples of this species led about the plains of India. These animals live to a considerable age; a brown bear lived in the well-known Stadtgrab at Berne, in Switzerland, for 47 years, and a female after 31 years of age bore young.

98. **Ursus torquatus.** *The Himalayan black Bear.*

Ursus thibetanus, *F. Cuvier*, *Hist. Nat. Mam.* pl. 213 (1824); *id. Ossemens Foss.* ed. 3, iv, p. 325; *Blyth, Cat.* p. 76; *Jerdon, Mam.* p. 70; *Lydekker, J. A. S. B.* xlvi, pt. 2, p. 285.
Ursus torquatus, *Wagner*, *Schreb. Säugeth. Supp.* ii, p. 144 (1841).
Helarctos tibetanus, *Horsf. Cat.* p. 124; *Adams, P. Z. S.* 1858, p. 518.
Ursus gedrosianus, *W. Blanf. J. A. S. B.* xlvi, pt. 2, p. 317; *id. P. A. S. B.* 1879, p. 4.

Rinch or *Rich*, *Bhálu*, H.; *Mam*, Baluchi; *Háput*, Kashmiri; *Sanár*, *Hing bong*, Nepalese; *Dom*, Bhotia; *Sona*, Lepcha; *Mágyen*, Limbo; *Sutum*, Daphla; *Situm*, Abor; *Mapol*, Garo; *Múphúr*, *Musu-bhurma*, Kachári; *Vúmpi*, Kuki; *Sawom*, Manipuri; *Húghúm*, *Thágua*, *Thega*, *Chúp*, *Seván*, *Sápá*, Naga; *Wek-won*, Burmese.

Size moderate. Fur smooth, not long or shaggy; hair of moderate length, without any woolly underfur; the hair on the shoulders is, however, considerably elongated in winter, giving the appearance of a hump. Claws comparatively short, strong, and curved. Ears rather large and covered with longish hair.

The skull behind the orbits is longer in proportion than that of *U. arctus*, and the muzzle is shorter. The sagittal crest is but slightly developed even in old animals.

Colour. Perfectly black almost throughout, with the exception of the inverted white crescent or horseshoe-mark on the chest which is narrow, with each end prolonged upwards in front of the shoulder. The chin, too, is white, and sometimes the nose is reddish brown, the upper lip being whitish. Occasionally the paws are said to be reddish brown. Claws black.

Dimensions. There is much variation, and males are larger than females. In several measurements of ordinary individuals given by Hodgson, the head and body vary from 4 ft. 8 in. to 5 ft. 5 in., but a very large male measured 6 feet 5 inches from nose to rump. The tail without hair measures 3 to 3½ inches, the hair at the end 1 to 1½ inches more, the planta or sole of the hind foot to the heel 7¾ to 9 inches; ear without hair and measured from crown of head 5 to 5¾. Weight of full-grown males 200 to 250 lbs. A good-sized adult skull from Nepal is 10 inches in basal length and 6·8 broad. As a rule this is a considerably larger and heavier animal than the sloth-bear of the Indian Peninsula.

Distribution. This bear is found throughout the forest-regions of the Himalayas, extending westward through parts of Afghanistan into Baluchistan and the Khirthar range on the west frontier of Sind. The western limits are about the frontier of Persia. To the eastward *U. torquatus* is found in the Assam ranges and some of the countries to the southward, being certainly found, though not common, in Pegu, where it was obtained by Theobald, and as

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far south as Mergui, whence Dr. Anderson obtained living specimens for the Calcutta Zoological Gardens. It also occurs in Southern China, Hainan, and Formosa. Whether the bear found in the plains of Eastern Bengal and Assam is this species or the sloth-bear, I cannot state positively. I once saw a skin of *U. torquatus* obtained from an animal that I was assured had been shot in Lower Bengal; and a writer in the 'Asian' of January 21st, 1888, states that he shot one in the Terai, close to the Patli Dun, North-west Provinces.

Synonymy. The specific name *thibetanus*, although the oldest, must be abandoned, because the animal, although common on the southern slopes of the Himalaya, is never found in Tibet itself. I was misled by a discoloured skin of very small size into giving a new name, *U. gedrosianus*, to the Baluchistan bear; but remarkable as it appears that a Himalayan and Chinese species should inhabit so very different a climate as that of Baluchistan, there appears no sufficient distinction to justify the separation of the bear from the latter country.

Habits. In the Himalayas and throughout its range, except in Baluchistan, the black bear is a forest animal. In the mountains it is found at various elevations from near the base of the hills to about 12,000 feet; usually in summer it ascends to 9000 or 10,000 feet or higher, whilst in winter it descends to 5000 feet or even lower. It is found frequently about villages, and often feeds in fields of grain or in fruit orchards; it has even been known to eat the pumpkins growing on the roof of a house. In winter it subsists largely on acorns. Its food consists mainly of fruits and roots; but whilst it does not dig so much for the latter as the brown bear, it is far more in the habit of climbing trees for fruit, and is not unfrequently found in fruit-trees at night or in the morning. It is also, like most bears, fond of honey, and is said at times to attack the beehives in villages. At the same time it is the most carnivorous of the Indian bears, and not only kills sheep, goats, deer, and even cattle and ponies, but occasionally feeds on carrion.

Some observers state that black bears hybernate, whilst Adams declares they do not. The fact is doubtless, as stated by Kinloch, that they do not hybernate completely as *U. arctus* does, but that they remain in a state of semitorpor, often in a hollow tree, during the cold months, moving about and feeding a little on milder days.

By all accounts the black bear is a much more savage animal than the brown bear, and as the former lives near villages, he more frequently comes in contact with men. Many natives are killed or severely injured by black bears in the Himalayas, and some Europeans; but still it appears an exception for even a wounded bear to charge. This animal is much sharper of sight and hearing than the Himalayan brown bear, and is said by some to have remarkable powers of scent; but by other accounts its sense of smell, though fairly acute, is very inferior to that possessed by deer or especially by wild sheep or ibex. It has the usual walk and quick

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but clumsy gallop of the family. It is an excellent swimmer, crossing swollen torrents with ease.

The usual den of this bear is in dense jungle, often in a cave or hollow tree amongst thick bush. As in the case of *U. arctus*, adults are generally found alone except in the pairing-season; but the cubs remain with the mother till full-grown, and those of two seasons are sometimes found with her at one time. This accounts for the parties of four or five bears occasionally noticed. The period of gestation has not been recorded, but is probably the same as in other bears; the young, usually two in number, are born in spring, and are very small, and blind for some time after birth. If captured young they are easily tamed, but are said to be less docile than the other three Indian species, and are certainly less frequently seen in captivity.

99. **Ursus malayanus.** *The Malay Bear.*

Ursus malayanus, *Raffles, Tr. Linn. Soc.* xiii, p. 254 (1822); *Blyth, Cat.* p. 76.
Helarctos malayanus, *Horsf. Zool. Journ.* ii, p. 234; *Cantor, J. A. S. B.* xv, p. 191; *Blyth, Mam. Birds Burma*, p. 30.
Helarctos euryspilus, *Horsfield, Zool. Journ.* ii, p. 221.

Wek-won, Burmese; *Bruang*, Malay.

Size small. Fur short and coarse. Claws well curved. Ears small, rounded, covered with short hair. Tongue very long.

Skull in adults very short and broad, nose short, zygomatic arches wide. Auditory bullæ more swollen than in *U. arctus* or *U. torquatus*. Incisors and canines large, premolars crowded and soon lost. Upper sectorial very small, its transverse section scarcely larger than that of the outer incisor. Molars short and very broad.

Colour. Black, brownish in parts. The muzzle including the eyes and the chin paler, often whitish; the crescentic patch on the chest white, yellow, or orange, with the two ends often broad, sometimes united into a large oval or heart-shaped spot with a black centre, and sometimes with the apex prolonged into a white streak on the abdomen. Claws pale horny, sometimes dusky.

Dimensions. Head and body about 4 feet, tail 2 inches, hind foot 7. The animal may grow to a rather larger size than this, but apparently never exceeds about 4½ feet in length. A full-grown Bornean female only measured 36 inches from nose to rump, tail 1 inch; weight 60 lbs. The ears are quite short, not more than 2 inches long. A very old and large skull is 8·5 inches long (basal length) and 8·3 broad; in younger skulls (fig. 52, p. 194) the breadth is proportionally less.

Distribution. This bear inhabits the Malay Peninsula, Sumatra, Java, and Borneo, and extends northwards into Tenasserim, Arakan, Chittagong, and the Garo hills. Throughout Burma, indeed, I learn from Dr. Anderson, both this and the preceding species

CSL

are found. Theobald, in Mason's 'Burma,' doubts if *U. malayanus* is found in Pegu.

Habits. But little known except in captivity. This bear is a purely forest animal and an admirable climber. It is essentially frugivorous, but like other bears occasionally kills and eats animals and birds. It is said to be very fond of honey, and it probably devours insects and their larvæ. Occasionally it is said to attack man. The instances of such attacks mentioned by Dr. Mason in his work on Burma may, however, have been due to *U. torquatus* and not to the present species.

In confinement *U. malayanus* soon becomes very tame if captured young, and from its activity and antics is very amusing. Good accounts of tamed animals are given by Sir Stamford Raffles, and by Col. McMaster in his 'Notes on Jerdon.'

Genus **MELURSUS**, Meyer (1794).

Syn. *Prochilus*, Illiger (1811).

The median pair of incisors in the upper jaw are wanting even in the young. Dentition: i. $\frac{4}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{2-2}{3-3}$. All the molars and premolars very small, the latter separated from each other by a considerable interval. Claws very large and powerful; snout elongate and mobile. Otherwise as in *Ursus*. Vertebræ: C. 7, D. 15, L. 5, S. 5, C. 11.

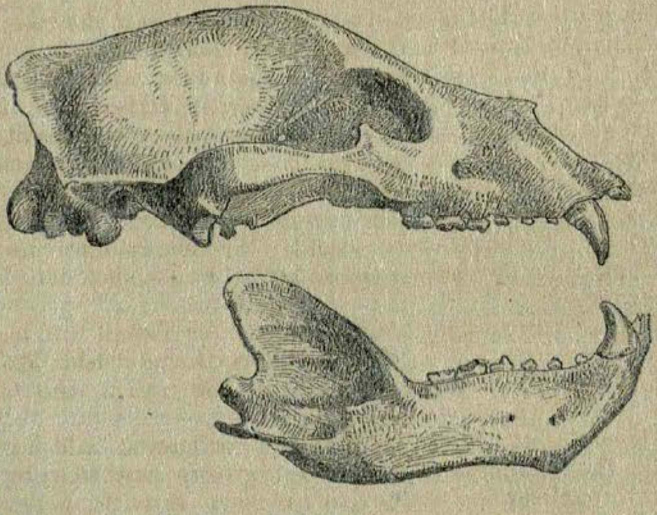

Fig. 53.—Skull of *Melursus ursinus*.

Only one species is known, and this is peculiar to the Indian Peninsula and Ceylon.

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100. **Melursus ursinus.** *The Sloth-Bear or Indian Bear.*

Bradypus ursinus, *Shaw, Naturalists' Miscellany*, ii, pl. 58 (c. 1791).
Ursus labiatus, *de Blainv. Bull. Soc. Philom.* 1817, p. 74; *Sykes, P. Z. S.* 1831, p. 100; *Elliot, Mad. Journ. L. S.* x, p. 100; *Tickell, Calc. Journ. N. H.* i, p. 199, pl. vii; *Blyth, Cat.* p. 77; *Jerdon, Mam.* p. 72.
Ursus inornatus, *Pucheran, Rev. Mag. Zool.* vii, p. 392 (1855).

Rinch or *Rich*, *Bhalú*, *Adam-zád*, H.; *Bhalúk*, Beng.; *Riksha*, Sanscr.; *Aswal*, Mahr; *Yerid*, *Yedjal*, *Asol*, Gond.; *Bir Mendi*, Oraon; *Bana*, Kol; *Elugu*, Tel.; *Kaddi* or *Karadi*, Can. and Tam.; *Pani Karudi*, Mal.; *Usa*, Cingalese.

Fur long and coarse, longest between the shoulders. In the skull the palate is broad and concave, and extends back farther than in other bears, covering about two thirds of the space between the posterior molars and the hinder terminations of the pterygoids.

Colour. Black, end of muzzle dirty grey; a narrow white horse-shoe-shaped mark on the chest. Claws white.

Dimensions. Head and body 4 ft. 6 in. to about 5 ft. 8 in. long; tail without hair 4 to 5 inches. Males as a rule are larger than females. Height at shoulder 2 ft. 2 in. to about 2 ft. 9 in. Weight of a small female 170 lbs.; large males weigh as much as 20 stone (280 lbs.) or more; I find one in the 'Asian' recorded as weighing 320 lbs. A large male skull is 11 inches in basal length, and 7·8 broad across the zygomatic arches.

Distribution. The peninsula of India from near the base of the Himalayas to Cape Comorin, and Ceylon, chiefly in hilly and jungly parts. To the west this bear is found in Kattywar and has occasionally been met with in Cutch, whilst further north its range appears to be limited by the Indian desert. The eastern limit is more doubtful. The sloth-bear appears to be found, though not commonly, in Eastern and Northern Bengal; but whether the bear of the Assam plains is this species or *Ursus torquatus*, I have not been able to ascertain. Theobald even suggests that the sloth-bear may occur in Pegu, as he possessed a young animal at Toungoo with but four upper incisors.

Habits. An excellent account is given by Tickell, and numerous details have been added by Jerdon, Forsyth, Sanderson, McMaster, and others, from which and my own observations the following notes are drawn up.

The sloth-bear is still one of the commonest wild animals of India, though its numbers have been greatly diminished by sportsmen throughout the country, and in some districts, as in parts of the Deccan and Bengal, where it was common 30 or 40 years ago, it has been exterminated. Wherever it occurs its presence is shown by the holes it digs to get at termites, by marks of its claws on trees that it has ascended for honey, and by its peculiar tracks.

These animals are generally found solitary or in pairs, or three together; in the latter case a female with two cubs, often nearly or quite full-grown. Occasionally four or five are met with in

MINISTRY OF CULTURE · GOVERNMENT OF INDIA
CSL

company. They inhabit bush and forest-jungle and hills, and are particularly fond of caves in the hot season and monsoon, and also when they have young. Throughout several parts of the peninsula of India there are numerous hills of a kind of granitoid gneiss that weathers into huge loose rounded masses. These blocks remain piled on each other, and the great cavities beneath them are favourite resorts of bears, as in such places the heat of the sun, and some of the insects (flies, mosquitoes, &c.) that are most troublesome in the monsoon, can be avoided. In the cold season, and at other times where no caves are available, this animal passes the day in grass or bushes or in holes in the banks of ravines. It roams in search of food at night, and, near human habitations, is rarely seen in the daytime; but in wild tracts, uninhabited by man, it may be found wandering about as late as 8 or 9 o'clock in the morning, and again an hour or even more before sunset in the afternoon. In wet or cloudy weather, as in the monsoon, it sometimes keeps on the move all day. But the sloth-bear, although, like most other Indian animals, it shuns the midday sun, appears by no means so sensitive to heat as might be expected from its black fur, and it appears far less reluctant to expose itself at noonday than the tiger is. I have seen a family of bears asleep at midday in May on a hill-side in the sun. They had lain down in the shade of a small tree, but the shade had shifted without their being disturbed. It is scarcely necessary to observe that this bear does not hybernate.

Owing to its long shaggy coarse fur, its peculiarly shaped head, its long mobile snout, and its short hind legs, this is probably the most uncouth in appearance of all the bears, and its antics are as comical as its appearance. Its usual pace is a quick walk, but if alarmed or hurried it breaks into a clumsy gallop, so rough that when the animal is going away at full speed it looks almost as if propelled from behind and rolled over and over. It climbs over rocks well, and, like other bears, if alarmed or fired at on a steep hill-side, not unfrequently rolls head over heels down hill. It climbs trees, but slowly and heavily, the unmistakable scratches left on the bark showing how often its feet have slipped back some inches before a firm hold was secured. I cannot, however, confirm the statement of some observers that this animal only ascends trees with rough bark; unless I am greatly mistaken I have seen its scratches far up the smooth stems of *kowá* trees (*Terminalia arjuna*).

The food of the sloth-bear consists almost entirely of fruits and insects. Amongst the former the jujube plum or *ber* (*Zizyphus jujuba*), the fruits of the ebony tree (*Diospyros melanoxylon*), *jamun* (*Eugenia jambulana*), *bel* (*Ægle marmelos*), and of various kinds of figs, especially *bar* or *banyan* (*Ficus indica*) and *gúlar* (*F. glomerata*), the pods of *Cassia fistula*, and the fleshy sweet flower of the *mhowa* (*Bassia latifolia*) are much eaten by these animals, each in its season, but many other wild and cultivated fruits are devoured when procurable. Beetles and their larvæ, the honey and young of bees, and above all the combs of termites or white ants furnish food for the Indian bear. In their nocturnal rambles these animals visit many fruit-trees, sometimes climbing amongst the branches to shake down the fruit, or standing up and dragging it down with their paws; they also turn over stones to search for insects and larvæ, ascend trees to plunder bees' nests, and dig out the nests of white ants, sometimes making holes 5 or 6 feet deep for this purpose. These holes are easily recognized by the marks of the bears' claws.

Tickell says (and his views are confirmed by others):—"The power of suction in the bear, as well as of propelling wind from its mouth, is very great. It is by this means it is enabled to procure its common food of white ants and larvæ with ease. On arriving at an ant-hill the bear scratches away with his fore feet until he reaches the large combs at the bottom of the galleries. He then, with violent puffs, dissipates the dust and crumbled particles of the nest, and sucks out the inhabitants of the comb by such forcible inhalations as to be heard at two hundred yards distance or more. Larvæ, especially the large ones of the *Atevchus sacer*, are in this way sucked out from great depths under the soil."

In Southern India bears are fond of the fermented juice of the wild date-palm, and climb the trees to get at the pots in which it is collected. The animals are said at times to get very drunk with palm-juice. They are very fond, too, of sugar-cane, and do much damage to the crops; they also occasionally eat various pulses, maize, and some other kinds of corn, and cultivated fruits such as mangoes.

According to Tickell, they rob birds' nests and eat the eggs. I have never heard an authenticated case of their killing larger animals for food, and as a rule they do not touch flesh; but Sanderson records an instance in which a muntjac that had been shot and left in the jungle was partly devoured by one, and he says that they often gnaw dry bones of cattle. McMaster also relates how the body of a bullock that had been killed by a tiger was pulled to pieces and devoured by two large bears. Young cubs reared in confinement eat flesh readily, cooked or raw.

The bears have a peculiar habit of sucking their paws and of making a humming sound at the same time, and the present species is much addicted to the practice. According to Tickell some tame young bears that he saw would suck any person's hand in the same manner as their own paws.

The eyesight of *Melursus ursinus* is by no means good, and it has a peculiarly comical way of peering about for intruders, that gives the idea of its being short-sighted. Its hearing is also, I believe, far from acute. Its sense of smell is much better; by scent it can detect honeycombs in a tree overhead, and nests of termites or larvæ of beetles at some depth below the surface of the ground. In smelling about for food, for instance when visiting fruit-trees at night, it makes a peculiar puffing sound that can be heard at a considerable distance.

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Except in puffing and humming, the Indian bears are quite silent animals as a rule, and have no call for each other. Occasionally, however, they make the most startling noise, whether connected with pairing or not I cannot say. I have only heard it in the beginning of the cold season, which is not their usual pairing-time. They occasionally fight under fruit-trees, but I think the noise then made rather different.

When surprised or disturbed, and especially when wounded, a bear is generally very noisy, uttering a series of loud guttural sounds. When hit by a bullet it is far more demonstrative than a tiger; indeed I have more than once known a tiger to receive a bullet without a sound, but I never knew a bear to be hit without much howling. Besides this, when a bear is mortally wounded and lies dying he almost always makes peculiar wailing cries. This has been observed by McMaster.

If two or more bears are together and one is wounded, a fight generally ensues, which Sanderson considers due to an attack by the unwounded animal or animals; but this is not necessarily the case, as I have seen an old female when hit attack two half-grown cubs that were with her, and cuff them heartily, and in one instance, when both of two bears were hit, they stood up on their hind legs and fought till one dropped dead from the bullet-wound.

As a rule the sloth-bear is a timid animal, but occasionally it attacks men savagely, using both its claws and teeth, and especially clawing the head and face. Sometimes, especially when surprised suddenly and attempting to escape, a bear merely knocks a man down with a blow of its claws, often, however, inflicting severe wounds; but in other cases it holds its victim with its claws and bites him severely, not leaving him until some time after he ceases to struggle. Many of the most savage attacks are made by female bears that have young with them, some are by wounded animals, but occasionally the onslaught appears quite unprovoked. The story of sloth-bears hugging is, I think, unknown to the natives of India, and is only repeated by those whose ideas on the subject are derived from European folk-lore.

There are, however, many folk-lore stories connected with the Indian bear. It is a common belief in parts of India that male bears abduct women. It is possible that the name of *Adam-zád* is connected with this story. The same belief exists in Baluchistan regarding *U. torquatus*.

Sportsmen in India generally either drive patches of jungle or hills, and shoot the bears as they run out, or else mark them down in the morning, and go up to their lair on foot. Elephants are seldom used, they have a great dread of bears, and are but rarely steady with them, and the country is frequently too rough and rocky for the sport. When bears inhabit hills, sportsmen occasionally post themselves before daybreak in a commanding spot, and intercept the animals on their return from their nocturnal rambles. Bears are occasionally speared from horseback, and have sometimes been hunted with large dogs and killed with a knife

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when seized. This is described by Sanderson. Jerdon gives an account of a curious method of hunting with dogs, practised by the Polygars, among the hills in the extreme south of the Peninsula. When the bear is brought to bay, the hunters each thrust a long bamboo loaded with strong bird-lime into the shaggy coat of their quarry, and thus hold him firmly. Nets have also been employed.

A wounded bear usually escapes without attempting to fight, and, unless he can get into a cave, runs away until he drops, no matter what the temperature may be, frequently going many miles. Occasionally, however, he charges desperately, but a shot in the face, whether it hits or not, will almost always turn him. There is a common idea, quite unfounded, that a bear always rises on its hind legs to attack, and may then be shot in the chest. It very rarely, if ever, does this when really angry and assailing an enemy already clearly recognized. The act of rising on the hind legs is generally due to surprise, and to an endeavour, on the part of the bear, to make out his enemy better.

The pairing-time appears to vary, but is generally about June, at the commencement of the monsoon. The period of gestation is said by Tickell to be seven months; if so, it rather exceeds that of other bears. The young are born at various times from October till February, but most often in December or January; they are usually two in number, the size of Newfoundland pups, are blind for the first three weeks (18 days according to McMaster), and are covered with soft, short hair, which after a couple of months becomes rougher and coarser. After a time (2 or 3 months I believe) the mother takes them with her, carrying them on her back, where they cling to the long hair. They ride thus, at times, until of tolerable size; one cub may sometimes be seen following its mother whilst the other is carried. They take between two and three years to reach maturity, and generally remain with the mother till full-grown. Sloth-bears have been known to live in captivity for 40 years. They are, when taken young, easily tamed, and, although fretful and querulous at times, generally playful, amusing, good-tempered, and much attached to their masters.

Except *Ursus syriacus* and *U. piscator*, which are probably, like *U. isabellinus*, local races of *U. arctus*, the only other member of the *Ursidæ* found in Asia is the very remarkable *Æluropus melanoleucus*, inhabiting Moupin, in Eastern Tibet. It has one premolar less than *Ursus* on each side of the lower jaw, and there is no alisphenoid canal, but otherwise the skull and dentition do not differ greatly from those of true bears. It is the size of a small brown bear; white, except the ears, a ring round each eye, the shoulders and legs, which are black. The soles of the feet are hairy.

MINISTRY OF CULTURE · GOVERNMENT OF INDIA
CSL

Order INSECTIVORA.

The order next to be considered comprises the tree-shrews, hedgehogs, moles, and shrews, besides several allied groups. A very curious animal called the flying lemur is also included. All are of greatly inferior organization to the Primates and Carnivora, and appear to be less specialized than any other order of placental mammals.

The account of the Insectivora is taken almost entirely from Mr. G. E. Dobson's Monograph, and to that work, in which all Indian forms receive full notice, the reader may be referred for complete anatomical details. The following are some of the principal characters of the order, quoted from the work named.

"Terrestrial, rarely arboreal or natatorial, diphyodont, heterodont, placental mammals of small size, with plantigrade or semi-plantigrade, generally pentadactyle, unguiculate feet, with clavicles (except in *Potamogale*), with more than two incisors in the mandible, and with enamel-coated molars having tuberculated crowns and well-developed roots.

"The extremity of the muzzle projects so far beyond the end of the mandible as to be almost characteristic. The testes are inguinal or abdominal, and are not received into a scrotum; the uterus is two-horned; the placenta discoidal and deciduate; and the smooth cerebral hemispheres do not extend backwards over the cerebellum."

Although the distinction of the teeth into incisors, canines, premolars, and molars is easy in some families, it is, as a rule, much less clear than in the higher Mammalia; and in many cases, as amongst the shrews, the incisors, canines, and anterior premolars can only be distinguished by their position in the jaw; the molar teeth are studded with sharp cusps.

By far the majority of the order are nocturnal, the *Tupaiidæ* being the only exception. The food consists chiefly of insects, except in the case of the aberrant *Galeopithecus*.

By most modern naturalists the Insectivora are divided into two suborders, thus distinguished:—

Upper and lower incisors conical, unicuspidate, or with basal cusps only, the lower not pectinate; limbs free	Insectivora vera.
Upper and lower incisors compressed, multicuspidate, the lower deeply pectinate; anterior and posterior limbs connected by a broad integumentary expansion, forming a parachute	Dermoptera.

It has recently been proposed by Mr. Oldfield Thomas to raise the *Dermoptera* to the rank of an order.

The fossil Insectivora are not very numerous, and none of any importance have been discovered hitherto in India.

Measurements of the smaller Insectivora, as of other micro-mammalia, are mostly from specimens preserved in alcohol.

Suborder *INSECTIVORA VERA*.

This suborder contains the following nine families, four of which are found within the limits of the British Indian Empire:—

A. Upper true molars narrow, with V-shaped crowns (not Indian) . .	**Chrysochloridæ** (Africa). **Centetidæ** (Madagascar). **Solenodontidæ** (West Indies). **Potamogalidæ** (Africa and Madagascar).
B. Upper true molars broad, multicuspidate, with more or less well-defined W-shaped crowns.	
a. Postorbital processes present; a cæcum generally developed; symphysis pubis long.	
a'. Orbital ring encircled by bone; metatarsus moderate: animal squirrel-like, arboreal . .	**Tupaiidæ.**
b'. Orbital ring not encircled by bone; metatarsus greatly elongate: terrestrial	**Macroscelidæ** (Africa).
b. Skull without postorbital processes; no cæcum; symphysis pubis short or wanting.	
a'. Crowns of first and second upper molars with a central fifth cusp; bullæ imperfect	**Erinaceidæ.**
b'. No central fifth cusp.	
a''. Zygomatic arches present; bullæ ossified.	**Talpidæ.**
b''. No zygomatic arches; bullæ imperfect . .	**Soricidæ.**

Family TUPAIIDÆ.

"Arboreal Insectivora, with comparatively large brain-case, orbits encircled with bone, and well-developed zygomatic arches. The malar bone is perforated, the tympanics form bullæ; the pubic symphysis is long; the tibia and fibula are distinct, the metatarsus but little longer than the tarsus; the molars are broad, with W-shaped cusps; and the intestinal canal has generally a short cæcum." (*Dobson.*)

The animals forming this family have a great similarity to squirrels, which they resemble in the general form of the body and limbs, and in having a more or less bushy tail. They differ from all other Insectivora in being not only arboreal but diurnal in

CSL

their habits, feeding by day. They are generally divided into two genera: *Tupaia*, the only form found in India and Burma, and spread throughout the greater part of the Oriental region, and *Ptilocercus*, the pen-tail, which is peculiar to Borneo. By some writers another Bornean species and a Cambodian one are distinguished as *Dendrogale*.

Genus TUPAIA, Raffles (1820).

Syn. *Glisorex*, Desm. (1822); *Cladobates*, F. Cuv. (1825); *Hylogale*, Temm. (1827).

The general form remarkably like a squirrel. Limbs well developed; feet naked beneath, the sole furnished with projecting pads, much as in a squirrel, there being especially a long, almost linear projection on the inner sole of the hind foot. Claws moderately curved and sharp. Head pointed; ears rounded. Tail bushy, distichous, clothed with long hair above and at the sides, and with short hair on the lower surface.

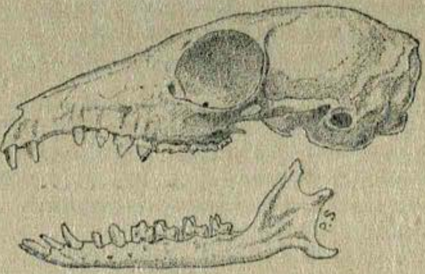

Fig. 54.—Skull of *Tupaia ferruginea*. (Anderson, An. Zool. Res. pl. vii.)

Dentition: i. $\frac{4}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$. The first or median upper incisors are at the end of the jaw, widely separated from each other and from the second incisors; the canine, which is similar in size and shape, follows after another even longer interval. The premolars increase in size backwards, the third, and in some species the second, having a well-developed inner lobe. Of the molars the first and second are nearly the same size, the third is much smaller. In the lower jaw the first two incisors are in contact, and project almost horizontally forward; the third is smaller; the canine is variable, being sometimes larger than the incisors, sometimes only the size of the third incisor.

Vertebræ: C. 7, D. 13, L. 5, S. 3, C. 23–26. Mammæ two pairs, one inguinal, the other axillary.

A full account of the osteology, together with descriptions of all the species, is given by Anderson in his 'Zoological and Anatomical Researches.'

Synopsis of Indian and Burmese Species.

A. Colour above speckled throughout; a more or less distinct shoulder-stripe.
  a. Throat and breast nearly white; dorsal fur uniformly coarse .... *T. ellioti*, p. 209.
  b. Throat and breast buff; coarser glossy hairs intermixed in dorsal fur .... *T. ferruginea*, p. 210.
B. Colour of lower back uniformly blackish; no shoulder-stripe....................... *T. nicobarica*, p. 212.

101. **Tupaia ellioti.** *The Madras Tree-Shrew.*

Tupaia ellioti, *Waterhouse, P. Z. S.* 1849, p. 107; *Blyth, Cat.* p. 82; *Jerdon, Mam.* p. 64; *Ball, P. A. S. B.* 1874, p. 95, 1877, p. 168; *Günther, P. Z. S.* 1876, p. 426; *Anderson, An. Zool. Res.* p. 124; *id. Cat.* p. 153.

Múnghil anathan (bamboo-squirrel), Tam.

Hair harsh, of uniform length and thickness, without coarser or longer piles.

A small and oval perforation in the malar bone. A well-developed inner lobe to the second upper premolar, forming half the breadth of the tooth. Inner lobe of third upper premolar nearly as wide (from front to back of tooth) as outer lobe. Inner lobe of first and second upper molars as wide as the outer lobe, and with a small cusp at both of the inner angles of each tooth.

Colour. Above yellowish-brown speckled, the middle of the back, the rump, and sometimes the upper surface of the tail, tinged to a variable extent with rusty red. Tail generally the same colour as the back. Lower surface of body nearly white, and a distinct pale stripe from the throat below the ear passing obliquely up in front of the shoulder. Hairs on the upper surface blackish at the base, then pale rufous or dirty white, with a black ring near the end, and the tip black. Hairs of tail with about three pale and three black rings, the basal ring being pale.

Dimensions. Head and body 7 to 8 inches, tail without the hair about half an inch less, with hair 8 to 9 inches, hind foot without claws 1·7; extreme length of skull 1·7, basal length 1·55, zygomatic breadth ·85.

Distribution. Throughout a large part of the Indian Peninsula south of the Indo-Gangetic plain, in forest. This species has been recorded from the Karakpur hills, near Monghyr, the Satpura hills south of the Nerbudda, Matheran near Bombay, Maunbhúm, Sambulpur, Vizagapatam, the Godavary, and the hills between Cuddapah and Nellore (the original locality). I have just received a specimen obtained by Mr. W. M. Daly on the Shevroy hills, but I have not heard of any tree-shrew being found in the forests, either of hills or plains, near the Malabar coast in the Madras presidency, nor in Ceylon.

Habits. This *Tupaia*, like other species, is found in trees in forests, and closely resembles squirrels in its movements. Its food consists of insects and, probably, of fruits. It is easily tamed.

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102. **Tupaia ferruginea.** *The Malay Tree-Shrew.*

Tupaia ferruginea, *Raffles, Linn. Trans.* xiii, p. 256 (1822); *Cantor, J. A. S. B.* xv, p. 188; *Horsf. Cat.* p. 131; *Blyth, Cat.* p. 81; *Günther, P. Z. S.* 1876, p. 425; *Anderson, An. Zool. Res.* p. 130; *id. Cat.* p. 156; *Thomas, P. Z. S.* 1886, pp. 67, 73.
Cladobates belangeri, *Wagner, Schreb. Säugeth. Supp.* ii, p. 42.
Tupaia belangeri, *Günther, P. Z. S.* 1876, p. 426; *Anderson, An. Zool. Res.* p. 126; *id. Cat.* p. 154; *Thomas, P. Z. S.* 1886, pp. 59, 67.
Tupaia peguana, *Lesson, Nouv. Tab. Reg. An., Mam.* p. 93 (1842); *Jerdon, Mam.* p. 65; *Blyth, Mam. Birds Burma,* p. 31; *W. Blanf. J. A. S. B.* xlvii, pt. 2, p. 152.
Tupaia chinensis, *Anderson, An. Zool. Res.* p. 129; *id. Cat.* p. 155.

Kalli-tang-zhing, Lepcha; *Tswai,* Burmese; *Tupai tana,* Malay (Penang).

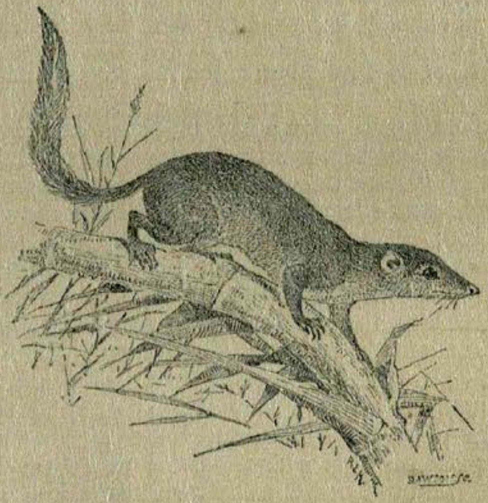

Fig. 55.—*Tupaia ferruginea.* (From a drawing by Col. Tickell.)

Fur soft, some of the hairs on the back coarser, longer, and distinguished by their lustre.

Perforation in the malar bone moderately large, oval. Inner lobe of second upper premolar variable, being occasionally nearly half the breadth of the tooth, but generally reduced to a very small size, and resembling a cingulum. Inner lobe of third upper premolar about half as wide (from front to back of tooth) as outer lobe. Inner lobes of first and second upper molars narrower than outer lobe, and with a small additional cusp at the posterior, but none at the anterior inner angle.

Colour. Above and on the sides varying from brown with a yellowish tinge to deep ferruginous, always speckled or grizzled, though less distinctly in ferruginous specimens. Tail and outside of limbs nearly the same as the back, except that in some ferruginous specimens the tail is less rufous. A pale oblique stripe, sometimes

GSL

indistinct, before each shoulder. Lower parts yellowish buff with more or less of a brownish tinge. Under surface of tail paler. Basal portion (generally half or more) of dorsal fur leaden black, terminal portion of shorter hairs yellowish white or pale rufous, the longer and coarser hairs having beyond the pale ring a long black tip, sometimes with a second subterminal pale ring. Long tail-hairs with alternating subequal rings of black and rufescent white, about three of each, the basal ring pale.

Dimensions. Head and body 6·5 to 7·75 inches, tail without hair 6 to 7, with hair 7 to 8, hind foot without claws 1·7; total length of skull 1·76, basal length 1·56, zygomatic breadth 0·9.

Varieties. By most writers the northern or Burmese race is distinguished, as *T. belangeri* or *T. peguana*, from that found in the Malay Peninsula and Islands, the true *T. ferruginea*, the colour of the former being yellowish brown, of the latter deep rusty brown. There appears, however, to be a passage between the two, many Tenasserim specimens being intermediate in coloration, with the lower back and rump ferruginous. Some differences in the form of the teeth and skull have been pointed out by Anderson and Thomas, but, so far as I can determine, they are not constant. A form from Yunnan and the hills of Upper Burma, near Bhamo, has been separated by Anderson as *T. chinensis*; but I feel doubtful if the characters pointed out (rather smaller size, and smaller teeth) justify specific distinction.

Distribution. Throughout Burma, extending to Assam, and along the lower slopes of the Himalayas, between 3000 and 6000 feet according to Jerdon, as far west as Nepal. To the southward the rufous form extends to the Malay Peninsula, Sumatra, Java, and Borneo. A specimen was obtained by Dr. Stoliczka on the island of Preparis, north of the Andamans.

Habits. This tree-shrew is found in tree-forest, sometimes in bamboos, in bushes, or trees about villages, and in Burma, according to both Mason and McMaster, in houses, living singly or in pairs. Both insects and fruit are eaten by it, and according to the natives of Sikhim small birds and mice. These animals are active, but McMaster considers them much less so than squirrels, and I am disposed to think he is right. Cantor, who appears to have kept several in confinement, states that they sit on their haunches when feeding, "holding their food between their fore legs, and, after feeding, they smooth the head and face with both fore paws, and lick the lips and palms. They are also fond of water, both to drink and bathe in."

According to the same observer, these tree-shrews are pugnacious, driving away all intruders of their own species from their usual hunting-grounds, and fighting each other when confined in a cage. Their call is a "short, peculiar tremulous whistling sound," when angry they utter "shrill protracted cries." Very little is known of their reproductive habits; the female is said usually to have only one young one at a time. They are easily tamed, and become at times, of their own accord, very familiar, entering houses, climbing on the tables and beds, and helping themselves to any food they may fancy. Mason mentions one that acquired a taste for tea and coffee.

103. **Tupaia nicobarica.** *The Nicobar Tree-Shrew.*

Cladobates nicobaricus, *Zelebor, Novara-Reise, Säugeth.* p. 17, pls. i, ii (1868).

Tupaia nicobarica, *Anderson, An. Zool. Res.* p. 136; *id. Cat.* p. 157.

Fur with some piles longer and coarser than the rest, and highly lustrous.

Skull more elongate than in *T. ferruginea*, but not approaching *T. tana* in this respect. Teeth large.

Colour. Above brownish black on the greater part of the back and tail; the muzzle, a band from the back of the head to between the shoulders, sides of the head and neck, and outside of limbs yellowish golden brown. Lower parts pale brown; lower surface of the tail except towards the base scarcely paler than the upper. No shoulder-stripe. The blackish hairs of the back and tail not annulated; on the brown portions the hair is indistinctly ringed light and dark brown.

Dimensions. Head and body 7·5 inches, tail with hair 10; weight 6 oz. In other specimens (males in alcohol): head and body 7·1, tail without hair 8, hind foot without claws 1·77. Skull of larger male 2·2 long, 1·2 broad.

Distribution. Nicobar Islands; hitherto not found elsewhere. The habits are not recorded.

The largest species of the genus is *T. tana*, found in Borneo. *T. javanica* is a small form that inhabits the Malay Peninsula, as well as the islands, and there are a few other species known.

Family ERINACEIDÆ.

Insectivora with plantigrade feet provided with simple, not fossorial claws, with well-developed radius and ulna, but having the fibula anchylosed below to the tibia, with long slender clavicles and a bifid acromion, with a narrow pubic symphysis, with slender zygomatic arches in which the small malar bones (rarely absent) are suspended, with well-developed pterygoid fossæ, with a ridge and process in front of the orbit, but without postorbital processes, with separate nasals, and with a ring-shaped tympanic bone not forming a bulla. The first and second upper molars with five cusps; the central cusp minute, united by a ridge on each side to the bases of the two internal cusps. The form of these teeth is very characteristic of the family. (*Dobson.*) No cæcum.

This family contains two genera only, differing remarkably in external form, each forming a distinct subfamily, and both occurring

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in British India and its dependencies. One of these genera (*Erinaceus*), containing the hedgehogs, is of wide distribution throughout the Palæarctic and Ethiopian regions; but in the Oriental region it is unknown east of the Bay of Bengal, although distributed over a considerable portion of India proper. The other genus, *Gymnura*, is peculiar to the south-eastern part of the Oriental region. All the forms are nocturnal.

The two subfamilies are thus distinguished:—

Back and sides covered with spines; tail very short.	*Erinaceinæ.*
Fur without spines; tail well developed..........	*Gymnurinæ.*

Full details of the anatomy of both subfamilies will be found in Dobson's monograph.

Subfamily ERINACEINÆ.

Genus **ERINACEUS**, Linn. (1766).

Back and sides covered with spines; tail very short, without spines; caudal vertebræ rudimentary. Skull short and broad; palate-bones with two large non-ossified spaces posteriorly, in front of a transverse ridge which is just behind the last molars; pterygoid fossæ very broad; no alisphenoid canal; mesopterygoid fossa very deep, and leading posteriorly into a deep hemispherical excavation between the auditory bullæ. Pelvis wide, with the ischial tuberosities not prolonged backwards.

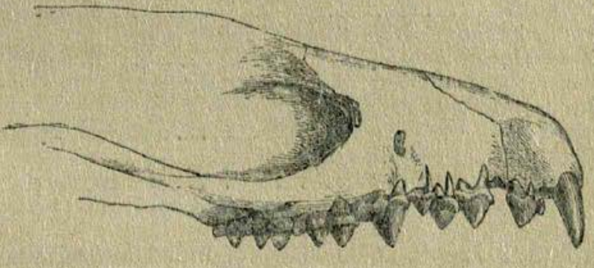

Fig. 56.—Upper jaw of *Erinaceus collaris*. (Dobson, P. Z. S. 1881, p. 403, fig. 11.)

Dentition: i. $\frac{6}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{2-2}$, m. $\frac{3-3}{3-3}$. The middle pair of upper incisors are considerably larger than the others, and are widely separated from each other; the third incisor and the canine are very similar to each other, and (except in *E. europæus*) two-rooted. The first premolar is also (with the same exception) two-rooted, the second is very variable, the third is much larger and three-rooted. The first molar is the largest tooth in the upper jaw, the second is of smaller size, the third very small.

The median lower incisors are large and conical, and directed almost horizontally forward, then come on each side three small teeth with oblique cusps, the second of which is the canine and the third the first premolar. The next tooth, or second premolar, corresponds to the fourth lower premolar of *Gymnura*, $\overline{\mathrm{pm.}\ 4}$; the first molar is, as in the upper jaw, the largest tooth in the jaw, the second being smaller and the third very small.

The vertebral formula is C. 7, D. 15, L. 6, S. 7, C. 5–6.

All the species possess skin-muscles more developed than in any other mammals, and these muscles enable hedgehogs to roll themselves into a ball for defensive purposes, the head and feet being entirely concealed, and only spines exposed.

The spines in all hedgehogs are longitudinally marked with fine grooves (or lirate). In all the Indian species, and in some others, the ridges between the grooves bear small tubercles. On the presence or absence of tubercles Fitzinger divided the genus and called the tuberculate forms *Hemiechinus*, but the character has no generic importance.

Dr. Anderson published, in 1878 (J. A. S. B. xlvii, pt. 2), a very useful monograph of the Indian species. The distribution of the genus in India is peculiar, and confined to the north-western portion (Baluchistan, Punjab, Sind, N.W. Provinces, and neighbouring tracts), and to the Madras Presidency in the south. No species has yet been recorded from the Central Provinces or Bengal.

Synopsis of Indian Species.

A. Spines on head without a naked furrow in the middle; $\mathrm{pm.}^{2}$ three-rooted.
  a. Head and body about 7 inches; longest spines 0·75 inch .... *E. collaris*, p. 215.
  b. Head and body nearly a foot; longest spines exceeding an inch .... *E. megalotis*, p. 216.
B. Spines on head divided into two groups by a naked furrow in the middle.
  a. Colour dark; $\mathrm{pm.}^{2}$ three-rooted .... *E. jerdoni*, p. 216.
  b. Colour pale; $\mathrm{pm.}^{2}$ with a single root.
    a'. Zygomatic arch perfect .... *E. pictus*, p. 217.
    b'. Zygomatic arch imperfect; malar absent *E. micropus*, p. 218.

Very little is known of the habits of Indian hedgehogs, but they probably closely resemble the European form *E. europæus*, except in not hybernating. The European hedgehog lives on insects, worms, slugs, snails, mice, rats, and other small mammalia, lizards, snakes, and any other small animals it can kill, also birds' eggs, fruit, and roots. Blasius states that the young, from four to eight in number, are born in July or August; but Dobson found the number not to exceed four, and believes that the period of gestation does not exceed a month. He shows, too, that a second brood is sometimes produced in autumn. The young at birth are almost naked, but the spines, at first soft, soon harden and grow rapidly, and the animals attain their full growth in about nine months.

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104. **Erinaceus collaris.** *Hardwicke's Hedgehog.*

Erinaceus collaris, *Gray and Hardwicke, Illust. Ind. Zool.* i, pl. 8 (1830–32); *Hutton, J. A. S. B.* xiv, p. 351; *Jerdon, Mam.* p. 62.
Erinaceus spatangus, *Bennett, P. Z. S.* 1832, p. 123.
Erinaceus grayi, *Bennett, P. Z. S.* 1832, p. 124; *Anderson, J. A. S. B.* xlvii, pt. 2, p. 204, pl. iv; *id. Cat.* p. 160; *Dobson, Mon. Ins.* p. 17.
Erinaceus blanfordi, *Anderson, J. A. S. B.* xlvii, pt. 2, p. 208, pl. v.

Kánta chua, Kanderna, Sinh, H.; *Khárpúsht, Jujuk,* P.; *Jaho, Tar-jara,* Sindhi. These names are also applied to other species of the genus.

Spines of moderate length, commencing behind a line joining the anterior margins of the ears, and not divided on the middle of the head by a naked space. Each spine surrounded by from 21 to 26 finely tuberculated ridges. Ears long, subtriangular, bluntly pointed at the tip. Feet well developed, claws strong; sole of fore foot with a large bifid pad behind, sole of hind foot without any prominent median pad behind opposite the hallux.

Skull short and broad, with a strong and perfect zygomatic arch. Second upper incisor about half the size of the third; second upper premolar well developed, in the same line as the other teeth, subtriangular in section, and furnished with three roots.

Colour dark. Fur on the lower parts and limbs blackish brown to dark reddish brown; the dark hairs on the face mixed with grey or lighter brown; chin whitish, this colour sometimes running along to the mandible and up the sides of the neck, but never forming quite so distinct a collar as in Hardwicke's original figure of the species. Ears usually with short brown hair outside, white inside.

Spines white for the greater part of their length, about the terminal third dark with a narrow white band near the tip, which is black. Occasionally specimens occur in which nearly the terminal half of each spine is black.

Dimensions. Head and body 6·75 inches, tail 1, ears from base 1·3 to 1·5, hind foot without claws 1·2 to 1·5, longest spines 0·75. Total length of skull 1·85 inches, basal length 1·8, zygomatic breadth 1·15.

Distribution. Throughout the Punjab, Sind, and North-western India as far east as Fatehgarh, and probably to Cawnpore, if not further. Unknown except in the plains.

Habits. According to Hutton, who obtained this species in Bahawalpur, *E. collaris* is found in sandy country, hiding in holes beneath thorny bushes or in tufts of grass during the day (I obtained specimens in similar places near Rohri in Sind), feeding chiefly on insects, especially a species of *Blaps*, but also on lizards and snails. It makes a grunting noise when irritated, and when touched suddenly jerks up its back so as to throw its spines forward, making at the same time a sound like a puff from a pair of bellows. Hutton also states that these animals bear long abstinence with apparent ease. Nothing is known of the breeding-habits of any Indian hedgehog.

105. **Erinaceus megalotis.** *The Afghan Hedgehog.*

Erinaceus megalotis, *Blyth, J. A. S. B.* xiv, p. 353 (1845); xv, p. 170; *id. Cat.* p. 80; *Anderson, Cat.* p. 163; *Scully, A. M. N. H.* ser. 5, viii, p. 223; *Dobson, Mon. Ins.* p. 18.

Size large. Spines long, each surrounded by twenty-seven to twenty-nine faintly tuberculated ridges, the spines on the head not divided by a naked space in the middle. Ears large, triangular. Feet well developed; claws strong; posterior pad of hind foot almost obsolete.

Skull larger than that of *E. collaris*, but otherwise similar. In a Kandahar specimen Scully found that the second upper premolar was two-rooted, but this is exceptional, and due to the two outer fangs being united into one.

Colour dark. Face and ears brown (cinereous according to Hutton), with a few white hairs intermixed; sides of head white, with brown hairs mixed; chin nearly white; lower parts, tail, and limbs dark sooty brown.

Spines brown at the base, then white, succeeded by a faint dusky band (occasionally absent), reaching nearly to the middle, then a broad whitish band succeeded by a narrower dark brown ring, followed by a white band and terminating in a dark brown tip. The dark ring on the proximal (or basal) half of the spine and the longer spines distinguish this form at once from *E. collaris*.

Dimensions. Length of head and body about a foot according to Hutton, tail 1·5 inches, ear from base 1·5, hind foot 1·55, longest spines 1·05; extreme length of skull 2·05 (in another skull 2·3), zygomatic breadth 1·2 (and 1·35).

Distribution. Apparently found throughout a large part of Afghanistan; the type was from Kandahar. This species has been found near Quetta by Hutton, St. John, and others.

Habits. Hutton says:—"They feed on slugs and *Helices*, with which the fields at Kandahar are overstocked; they also prey on worms, insects, and lizards. They hide during the day in holes, and come out in the evening to feed. They retire to hybernate in deep holes in the earth in the end of October or beginning of November, according to the season, and remain in a semi-torpid condition till February, when they again appear."

106. **Erinaceus jerdoni.** *Anderson's Hedgehog.*

Erinaceus jerdoni, *Anderson, J. A. S. B.* xlvii, pt. 2, p. 209, pl. v *a* (1878); *id. Cat.* p. 165; *Dobson, Mon. Ins.* p. 16.

Spines long, each surrounded by about nineteen tuberculated ridges, those on the forehead commencing between the ears in two belts divided by a nude area along the middle of the head. Ears large, subtriangular. Feet well developed; claws strong; hind foot with a large posterior pad in the middle opposite the hallux.

Skull more elongate than in other Indian species, with a perfectly formed zygomatic arch. Second upper premolar well developed, in the same general line as the other teeth, and with three roots.

Colour very dark. The head and the ears outside are grey covered with white and dark brown or black hairs mixed, the inside of the ears white. Chin, throat, and sides of neck whitish; chest whitish brown; remainder of lower parts, limbs, and tail dusky brown, darkest posteriorly.

Spines dusky at the base, then white, followed by a dark band, then another white one, and a long black tip. This is the usual coloration; but on the forehead there are, in some cases at all events, three white and three black rings; again, in some specimens the rings are less numerous than usual.

Dimensions. Head and body 7·5 inches, tail 1·25, ear from base 1·4, hind foot without claws 1·5, longest spine 1·15; extreme length of skull nearly 2, zygomatic breadth 1·1.

Distribution. The Punjab and Sind. The most north-westerly locality recorded is Thal, Karram valley. Specimens from Pind Dadun Khan, referred by Blyth to *E. collaris*, are identified with the present species by Anderson. Other localities are Rájanpur, Rohri, and Karáchi.

Nothing is known of the habits.

A form allied to *E. jerdoni*, but distinguished by its larger size and very long spines, *E. macracanthus*, has been obtained at Kandahar and at Dizak in Persian Baluchistan as well as in Persia, and will in all probability be found in Eastern Baluchistan also *. It is described and figured in 'Eastern Persia,' ii, p. 27, pl. i (see also Scully, A. M. N. H. ser. 5, viii, p. 224). The ears are large and pointed. The spines on the head are divided, and the second premolar three-rooted. The colour of the spines is usually black at the tip and for the terminal third; the basal two thirds brown, with two white rings. The face is covered with black and white hairs mixed; lower parts to breast inclusive white; abdomen brown, becoming blackish behind; tail and all limbs blackish brown. Albino individuals appear common. Head and body 9·5 inches, tail 1·25, ear from base 2, longest spines 1·5, length of skull 2·2.

107. Erinaceus pictus. *Stoliczka's Hedgehog.*

Erinaceus pictus, *Stoliczka, J. A. S. B.* xli, pt. 2, p. 223 (1872); *Anderson, J. A. S. B.* xlvii, pt. 2, p. 203, pl. iii.; *id. Cat.* p. 159; *Dobson, Mon. Ins.* p. 13.

Spines commencing on the forehead in front of the ears, and divided by a nude median space on the top of the head; each spine surrounded by seventeen to twenty-two finely tuberculated ridges. Ears rounded, longer than in *E micropus*, and rising, when erect, above the spines. Feet small and short, with very short toes; nails small.

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* Murray ('Indian Annals,' i. p. 118) states that he has this species from Zandra and Sir-i-Bolán, near Quetta.

Skull short and wide across the zygomatic arches, which are perfect, with a well-developed malar bone. The second upper premolar small, externally situated and single-rooted, but by no means so minute as in *E. micropus*.

Colour pale, identical with that of *E. micropus*. Muzzle, including the eyes, and a band from the eyes to the side of the neck, lower half of fore limbs, lower abdomen, rump, tail, and hind limbs brown; forehead, sides of neck, and underparts to abdomen white. Spines white or yellowish white, with a broad subterminal band brown. Tip white, the extreme point occasionally dusky.

Dimensions. Head and body in males 6 to 7·75 inches, in females 5 to 6, tail 0·5 to 0·8, length of ear from base 1 to 1·4, fore foot 0·7, hind foot 1, longest spine 0·75; extreme length of skull 1·6, zygomatic breadth 1.

Distribution. North-western India, the Punjab, Sind, Cutch, and Rájputána, as far east as Agra and Goona.

Habits. This animal is usually found during the day in holes, such as deserted fox-burrows or under tufts of grass. It appears to be by no means rare in the drier parts of North-western India, but, owing to its nocturnal habits, is but rarely seen. Its food and habits in general are but little known, but doubtless resemble those of other species.

108. **Erinaceus micropus.** *The South-Indian Hedgehog.*

Erinaceus micropus, *Blyth, J. A. S. B.* xv, p. 170 (1846); xxii, p. 582; *id. Cat.* p. 80; *Jerdon, Mam.* p. 63; *Anderson, J. A. S. B.* xlvii, pt. 2, p. 200, pl. v *a*; *id. Cat.* p. 159; *Dobson, Mon. Ins.* p. 14.
Erinaceus nudiventris, *Horsf. Cat.* p. 136.

Mollu-yelli, Tam.

Spines commencing on the forehead in front of a line between the inner angles of the ears and divided by a nude median space on the top of the head. Each spine with seventeen to twenty-two longitudinal minutely tuberculated ridges. Ears rounded at the tip, not rising above the spines. Feet short, with short claws. Hair on lower parts thin.

The skull is distinguished from that of every other species of the genus by the imperfect zygomatic arch, the malar bone being absent and represented by cartilage. The cranium is longer and narrower than that of *E. pictus*. The second upper premolar is exceedingly small, scarcely discernible without a lens, external to the general line of the teeth, and one-rooted.

Colour pale. Muzzle, including the eyes, and a band from the eyes to the side of the neck behind the gape, lower (distal) half of fore limbs, hinder abdomen, and rump, with the hind feet and tail, brown; a broad band on the forehead, sides of neck, throat, chest, and anterior abdomen, with the sides of the body below the spines, white.

Spines white or yellow, with a dark broad subterminal band; tip white.

Dimensions. Head and body 6 inches, tail 0·5, height of ear from base 1 to 1·1, hind foot without claws 1·1, longest spine 0·8. Skull, total length 1·75 inches, basal length 1·65.

Distribution. The plains of Southern India, in the neighbourhood of Madras, Trichinopoly, Coimbatore, &c. Other localities, such as Cottyam, in Travancore, require confirmation, and the repeatedly asserted occurrence of this form on the Nilgiris is shown by Anderson to be incorrect; the animal is, however, found on the eastern slopes towards the base. The northern range of the species is not known, but if any hedgehog be found in the Bombay Deccan, as stated by Adams and apparently confirmed by later observers in the 'Bombay Gazetteer,' it is probably the present species. It is remarkable, however, that none was obtained by Sir W. Elliot in the Southern Mahratta country, and I do not remember ever seeing a hedgehog myself in the Bombay Deccan or the Central Provinces. If, as Kelaart thinks probable, there is a hedgehog in Ceylon, it is most likely to be *E. micropus*.

Nothing especial appears to have been recorded of the habits of this species.

Other Asiatic species of hedgehog are *E. auritus* from Southern Siberia, the Caspian region, and Mesopotamia, and *E. albulus* from Eastern Turkestan.

Subfamily GYMNURINÆ.

Genus **GYMNURA**, Horsf. & Vigors (1828).

Syn. *Echinosorex*, Blainv. (1831); *Hylomys*, Müller and Schlegel (1839).

Fur without spines. Caudal vertebræ numerous and well developed. Head long, and nose pointed; ears rounded; feet and claws well developed; tail nearly naked. Skull long; zygomatic arches very slender; palate-bones completely ossified posteriorly, but with a transverse ridge, as in *Erinaceus*, behind the posterior molars; mesopterygoid fossa not terminating behind in a deep excavation; pterygoid fossæ broad; an alisphenoid canal present. Pelvis very narrow, with the ischial tuberosities much prolonged backwards.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{3-3}{3-3}$. Middle upper incisors much larger than the others, and separated from each other; the next pair are smaller, the outer pair smaller still; all single-rooted. The canine is slightly larger than the first (middle) incisor, and two-rooted. The first two upper premolars are very small, the third varies in the two species; the fourth is large, and has four roots. The molars are similar to those of *Erinaceus*.

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In the mandible the lower incisors diminish progressively behind; the canine is larger, and resembles the upper canine, but has only one root; the first two premolars are small, the third larger, the fourth still larger, and higher than the molars, of which the first, as in the upper jaw, is the largest tooth in the jaw, the others diminishing in size progressively.

The vertebral formula differs considerably in the two species. Mammæ two pairs: one thoracic, near the axilla, the other pair inguinal.

Both forms of *Gymnura* somewhat resemble large shrews. Until lately they have been placed in distinct genera, the smaller form being classed as *Hylomys*; but Dobson has united them, and although I feel some misgivings as to their being congeneric, there can be no doubt about their near relationship. Both occur in Burma, but are unknown west of the Bay of Bengal.

Synopsis of Burmese Species.

A. Larger; head and body 12 to 14 inches; tail three fourths that length .... *G. rafflesi*, p. 220.
B. Smaller; head and body about 5 inches; tail one sixth that length .... *G. suilla*, p. 221.

109. **Gymnura rafflesi.** *Raffles's Gymnura.*

Viverra gymnura, *Raffles, Tr. L. S.* xiii, p. 272.
Gymnura rafflesii, *Horsfield and Vigors, Zool. Journ.* iii, p. 248, pl. 8 (1827); *Cantor, J. A. S. B.* xv, p. 190; *Blyth, Cat.* p. 81; *W. Blanf. J. A. S. B.* xlvii, pt. 2, p. 150; *Anderson, Cat.* p. 158; *Dobson, Mon. Ins.* p. 3.

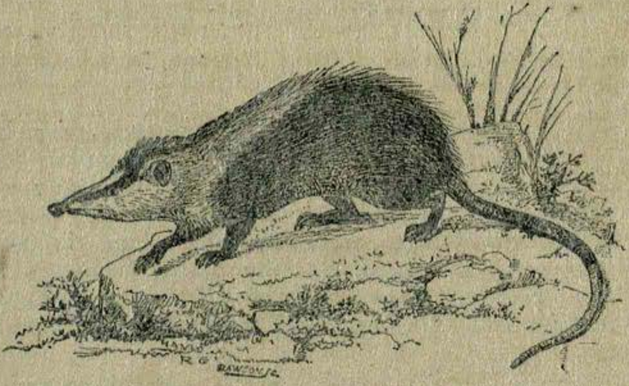

Fig. 57.—*Gymnura rafflesi.*

Tail about three fourths the length of the head and body, compressed towards the tip, naked, scaly, the scales small and arranged in rings, between which short hairs project, becoming coarse bristles on the under surface, where the scales are more convex and more distinctly imbricate than above. Ears short, rounded, almost naked. Body clothed with hair of two kinds, the underfur soft and woolly, the longer hairs coarse bristles. Claws curved, not retractile.

Skull very long and narrow, third upper premolar much larger than the second, and having three roots.

Vertebræ: C. 7, D. 15, L. 5, S. 3, C. 28.

Colour. Partly white, partly black, the distribution of the two colours being somewhat variable; generally the head and neck are white, with the exception of a black patch above and in front of each eye, and often a variable proportion of black bristles is mixed with the white of the crown. The anterior portion of the back is clad with mixed white and black hairs, the proportion varying, the underfur being blackish. On the hinder back, sides, limbs, and lower parts the longer hairs are generally black, but in one specimen from Tenasserim there was a line of white down the middle of the breast and belly. Some Burmese specimens are entirely white. The woolly underfur is dusky olivaceous at the base on the upper parts, ashy on the lower, brownish or sooty black at the tips. Terminal portion of tail usually white.

Dimensions of a Tenasserim female. Head and body 12 inches, tail 8·5, ear 1, hind foot without claws 2·15, extreme length of skull 2·8. But Sumatran, and especially Bornean, specimens are considerably larger, the head and body measuring over 14 inches; skull 3 to 3·5 in length, and 1·6 across the zygomatic arches.

Distribution. The Malay Peninsula, Sumatra, and Borneo. Found in the extreme south of Tenasserim at Bankasun by Mr. Davison. The occurrence of this species in Mergui had already been shown to be probable by Mr. Blyth (see J. A. S. B. xliv, pt. 2, extra number, p. 32).

Habits. Very little is known. The species is purely nocturnal, and lives under the roots of trees. The contents of the stomach show that the food consists of insects, amongst which *Blattæ*, termites, and various forms of larvæ are especially common. The animal has a peculiar offensive smell, not musky, rather alliaceous, described to me by Mr. Davison as resembling Irish stew that had gone bad.

110. **Gymnura suilla.** *The smaller Gymnura.*

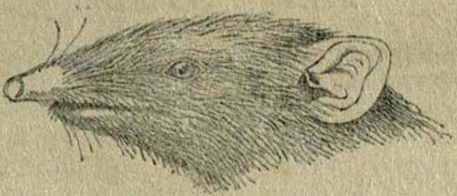

Fig. 58.—*Gymnura suilla.* (Anderson, An. Zool. Res. pl. vi.)

Hylomys suillus, *Müller & Schleg. Verhandl. Mam.* p. 153, pl. xxv, figs. 4–7, pl. xxvi, fig. 1 (1839–44); *Blyth, Mam. Birds Burma*, p. 32.

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Hylomys peguensis, *Blyth, J. A. S. B.* xxviii, p. 294; *id. Cat.* p. 82; *Anderson, Tr. Z. S.* viii, p. 453, pl. 64; *id. An. Zool. Res.* p. 138, pl. vi; *id. Cat.* p. 157.
Gymnura suilla, *Dobson, Mon. Ins.* p. 5.

Tail short, one sixth the length of the head and body, almost naked, and covered with small scales arranged in rings. Ears rather larger proportionally than in *G. rafflesi*, rounded, almost naked. Body clothed with hair of three kinds, the inner fine, the longer coarse and bristly. Claws stout, but little curved.

Skull not so long as that of *G. rafflesi*. Third upper premolar scarcely larger than the second. Vertebræ: C. 7, D. 14, L. 6, S. 4, C. 14.

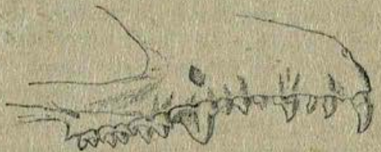

Fig. 59.—Upper teeth of *Hylomys suillus* (Anderson).

Colour. Above rusty brown, below pale yellowish white; the seminude portions of the limbs and tail brownish yellow. The hairs on the back are tipped with black.

Dimensions. Head and body 4·9 inches, tail 0·9, length of ear 0·6, breadth the same, hind foot 1. Length of skull 1·4, zygomatic breadth 0·75.

Distribution. Burma, Malay Peninsula, Sumatra, and Java. Within our area this animal has been hitherto found in only two localities rather distant from each other—first by Major Berdmore near Shwe Gyeng, on the Sittoung (Sitang) river; secondly by Dr. Anderson on the Kakhyen hills, east of Bhamo, at an elevation of 3000 feet. Probably *G. suilla* exists in many parts of Burma.

Nothing is known of the habits of this species. The above description is taken from that by Anderson, as I have been unable to examine a specimen.

Family TALPIDÆ.

Fossorial, rarely natatorial or cursorial Insectivora, having their fore limbs more or less modified for digging, and very anteriorly placed, owing to the shortness of the clavicles and forward extension of the manubrium sterni, with which they are articulated; with a short humerus articulating with both the scapula and the clavicle; with well-developed radius and ulna, but with united tibia and fibula; without symphysis pubis, the pubic bones being widely separated, while the acetabula are approximated; with elongated skull, provided with slender zygomatic arches and

GSL

tympanic bullæ osseæ, but without postorbital processes of the frontals; and with a cæcumless intestinal canal. (*Dobson.*)

Although some non-Indian genera constituting the subfamily *Myogalinæ* are intermediate in form between moles and shrews, the typical moles, which are the only members of the family hitherto found within Indian limits, are easily distinguished by their thick, cylindrical bodies, short legs, and enormous fore feet, and by their peculiar short, soft, velvety fur, the hairs of which are set vertically in the skin, not directed backwards.

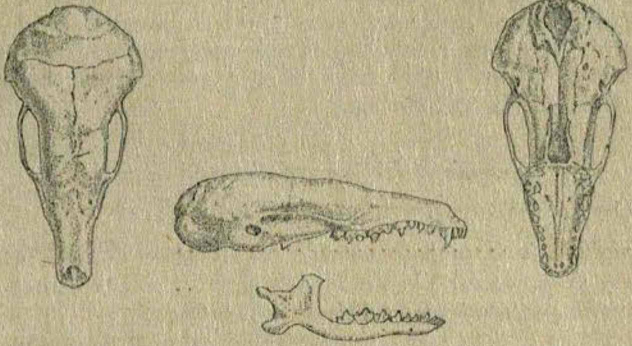

Fig. 60.—Skull of *Talpa europæa.* (Dobson, Mon. Ins. pl. xx.)

The eyes are minute and frequently covered by the skin, the ears short and generally concealed by the fur.

The true molars have always well-defined **W**-shaped cusps, with horizontal internal basal processes. The front incisors above and below are unicuspidate, and the lower are not extended horizontally forward as in the shrews.

The mole family is only found in the Palæarctic and Nearctic regions, and in a small portion of the Oriental region. The peculiar section said by Jerdon to occur in Africa consists of the golden moles, *Chrysochloridæ*, now placed in a distinct family. Nearly all the forms are subterranean in habit and, like most other Insectivora, nocturnal.

Genus **TALPA**, Linn. (1766).

Syn. *Parascaptor*, Gill, 1875.

Form typical. Legs and feet, the anterior pair especially, entirely modified for digging, the fore feet, which are normally turned outwards instead of downwards, being very broad and flat and furnished with large claws; the humerus, radius, and ulna very short and strong, and the clavicle, in some species, as broad as long. The great breadth of the fore feet is partly due to a peculiar development of the proximal inner wrist-bone, or radial sesamoid, which is a large curved ossicle known as the falciform bone (*os falciforme*).

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Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$ or $\frac{3-3}{4-4}$, m. $\frac{3-3}{3-3}$. The incisors are chisel-shaped, and arranged in a semicircular row, as in most other Mammalia (but not generally in the Insectivora), the median upper pair slightly larger than the others. Upper canines long, conical, double-rooted. Three anterior upper premolars (two in *T. leucura*) small, subequal, double-rooted, the fourth larger, with three roots, followed by three large molars. Lower canines undistinguishable from incisors; first lower premolar large, resembling a canine, the next two small, the fourth again larger.

Vertebræ: C. 7, D. 13, L. 6, S. 5, C. 8–12. Mammæ 6.

Moles are more completely fitted for a subterranean life than any other known mammals, the whole organism being adapted for burrowing. Three species have been recorded from the Himalayas, Khási Hills, and Burma.

Synopsis of Indian and Burmese Species.

Tail subcylindrical, one fourth length of head and body; pm. $\frac{4-4}{4-4}$ ……………………………	*T. europæa*, p. 224.
Tail very short, concealed by the fur; pm. $\frac{4-4}{4-4}$ ..	*T. micrura*, p. 225.
Tail club-shaped, about one twelfth of total length; pm. $\frac{3-3}{4-4}$……………………………	*T. leucura*, p. 226.

111. **Talpa europæa.** *The European Mole.*

Talpa europæa, *L. Syst. Nat.* i, p. 73 (1766); *Dobson, Mon. Ins.* p. 137.

Talpa macrura, *Hodgs. J. A. S. B.* xxvii, p. 176; *Jerdon, Mam.* p. 51.

Tail about one fourth to one fifth the length of the head and body, slender, nearly of the same thickness throughout, clad with hair. Feet thinly clad with hair above.

The fourth upper premolar without any distinct internal basal process. The fourth lower premolar decidedly smaller than the first.

Colour. Black, varying to bluish black or sooty black, and occasionally to grey, yellow or even white. The basal portion of the hairs is dark leaden grey, the extreme tips often more or less grey. There is scarcely any difference in tint between the upper and lower parts.

Dimensions. In an adult European male, head and body 5·5 inches, tail 1·35, fore foot and claws 0·9 long, 0·7 broad, hind foot and claws 0·85 long. Basal length of skull 1·25, total length 1·4.

The type of Mr. Hodgson's *T. macrura* measured: head and body 4 inches, tail $1\frac{1}{16}$ without hair, $1\frac{1}{4}$ with, fore foot and nails $\frac{3}{4}$. These measurements were perhaps taken on the skin.

Distribution. The greater portion of the Palæarctic region from England to Japan. There are specimens from the Altai mountains in the British Museum. A solitary example was procured by Mr.

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Hodgson at Darjiling. I cannot see any evidence in Mr. Hodgson's description or in his MS. notes, now in the Zoological Society's Library, that he examined this mole in the flesh; and as not one of the numerous collectors in Darjiling, since Mr. Hodgson's time, is known to have come across a second specimen, I cannot help doubting whether the type of *T. macrura* may not be a European skin, accidentally mixed with Mr. Hodgson's collection. A second specimen in spirits has been found amongst the collections of the Indian Museum, now added to the British Museum, but no locality is recorded. It is worthy of note that, as I am informed by Mr. Oldfield Thomas, a skull from the Altai shows a slight difference in the form of one of the upper molars from European specimens, whereas the supposed Himalayan skull exhibits no such distinction.

Habits. Moles live in burrows dug by themselves, and of complicated form. These have been described by many writers. The abode itself is usually under a hillock, or beneath roots of trees, and consists of a central chamber with passages leading to two circular galleries, one higher in position and smaller in diameter than the other. Several diverging runs lead from the larger gallery, one alone (the main run) being of great length, and conducting to the burrows dug in various directions for the purpose of procuring food. The last are extended daily, and their presence indicated on the surface by small piles of earth, the well-known mole-hills.

The principal food of the mole consists of earthworms, insects and their larvæ, snails and slugs; mice, shrews, and even frogs are also devoured. No animal is more voracious. Males are more numerous than females and fight for the possession of the latter. The pairing-time is about March in Europe, the period of gestation six weeks, and from four to six young are usually produced at once. Moles take to water readily and swim well.

112. **Talpa micrura.** *The short-tailed Mole.*

Talpa micrura, *Hodgs. J. A. S. B.* x, p. 910; *Blyth, J. A. S. B.* xi, p. 95; xix, p. 215, pl. iv, fig. 2 (skull); *id. Cat.* p. 88; *Jerdon, Mam.* p. 51; *Dobson, Mon. Ins.* p. 139.
Talpa cryptura, *Blyth, J. A. S. B.* xii, pp. 177, 928.

Pariam, Lepcha; *Biyu-kantyem*, Bhot.

Tail extremely short, nearly naked, and completely concealed by the fur; caudal vertebræ 8. Feet nearly naked above. Eyes covered by skin.

Fourth upper premolar with a large internal basal process. Fourth lower premolar as large as the first or larger.

Colour uniform velvety black when fresh, with a more or less silvery grey gloss; basal portion of fur leaden grey to leaden black. Dried skins are often brown. Snout and feet whitish or pale flesh-colour.

Dimensions in spirit: head and body 4·75 inches, tail 0·2, fore

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foot and claws 0·9, hind foot and claws 0·8. In fresh specimens the head and body measure 5 to 6 inches. Length of skull 1·37 inches. Weight 2½ oz.

Distribution. The south-western Himalayas, especially Nepal and Sikhim, and the hills south of Assam. About Darjiling this animal occurs at a moderate elevation, 5000 or 6000 to 8000 feet, and is common near the station. It may be found at lower levels. Dobson gives Kashmir amongst the localities, perhaps on the authority of Mountstewart Elphinstone ('Caubul,' p. 142); but in this case, and in Kumaon, where also moles have been said to occur (As. Res. xvi, p. 153), it is possible that piles of earth thrown out by *Nesokia* have been mistaken for mole-hills. The instances mentioned are quoted by Blyth (J. A. S. B. xi, p. 95).

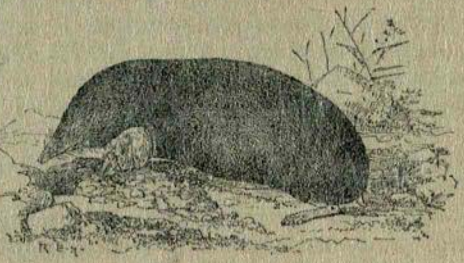

Fig. 61.—*Talpa micrura.* (From Hodgson's drawings.)

Habits. Around Darjiling the short-tailed mole inhabits the deep bed of black vegetable mould found wherever the original forest has not been destroyed. This mould contains earthworms and larvæ of insects, the chief food of moles, in abundance. Jerdon noticed that the runs of *T. micrura* often proceeded from the base of one great oak to that of another. Such runs are not marked by mole-hills, as in the case of the European species. Nothing is known of the breeding of *T. micrura.*

113. **Talpa leucura.** *The white-tailed Mole.*

Talpa leucura, *Blyth, J. A. S. B.* xix, p. 215, pl. iv, figs. 1, 1 *a* (skull & tail) (1850); xx, p. 518; xxviii, p. 294; *id. Cat.* p. 88; *id. Mam. Birds Burma*, p. 33; *Anderson, Cat.* p. 170.
Parascaptor leucura, *Dobson, Mon. Ins.* p. 140.

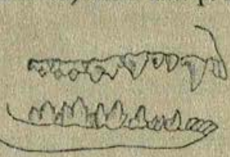

Fig. 62.—Dentition of *Talpa leucura.* (Dobson, Mon. Ins. pl. xx.)

Smaller than *T. micrura*, and muzzle shorter. Tail about one twelfth of total length or rather more, club-shaped, being thicker towards the end than near the base, thinly clad, the hairs coarser and longer than those of the body. Caudal vertebræ 8. Eyes covered.

Upper premolars only three (so that there are six teeth only behind the canine instead of seven as in the other moles), third with a large internal basal process. In the lower jaw the second and third premolars are small and very closely packed, the fourth is equal in size to the first.

Colour uniform brown in all skins I have examined, but described as black by Anderson, perhaps variable. Basal portion of fur leaden black. Tail-hairs whitish or white.

Dimensions. An adult female in spirit measured: head and body $4\frac{1}{3}$ inches, tail $\frac{3}{8}$. Total length of skull 1·2 inches, basal length 1.

Distribution. Sylhet and the Khási and Naga hills, south of Assam; found up to 10,000 feet above the sea. This species was also obtained by Major Berdmore in the valley of the Sittoung river, near Shwegyeng, and probably exists in places throughout Burma.

Nothing is known of the habits of this mole.

Some years since, the Rev. H. Baker found black velvet-coated animals that he took for moles in Malabar (J. A. S. B. xxviii, p. 286); but although it is difficult to say what they were, especially as the feet were mole-like, the coloration (black above, white below) is remarkable in the genus *Talpa*. No animal hitherto described from Malabar coincides with Mr. Baker's description.

Two remarkable genera of *Talpidæ*, each represented by a single species—*Scaptonyx fuscicaudatus* * and *Uropsilus soricipes* †—have been described from Eastern Tibet by A. Milne-Edwards. The first is about the size of a common mole, but with narrower fore feet, the colour is brown. The second is smaller, and has the feet of a shrew, whilst its dentition is somewhat intermediate between a shrew's and a mole's.

Other Asiatic genera are *Myogale*, *Scaptochirus*, and *Urotrichus*.

Family SORICIDÆ.

Terrestrial, rarely natatorial Insectivora, with narrow elongated skulls, without postorbital processes or zygomatic arches. The tympanics are annular, not forming bullæ; there is no symphysis pubis ‡, the tibia and fibula are united; and the molars have well-developed **W**-shaped cusps. (*Dobson.*)

All shrews are covered with hair, generally very soft; the head is long, the eyes small, the snout very pointed and projecting very considerably beyond the lower lip; the ear-conch, when present, rounded and somewhat resembling the human ear in shape. The pointed nose, rounded appressed ears, and the teeth at once distinguish shrews from rats and mice, with which the former are often popularly confounded.

The dentition is characteristic of the family. Dobson has

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* Recherches Mam. p. 278, pl. 38 B, fig. 4, and pl. 40 B, fig. 2.

† *Ibid.* p. 272, pl. 40, fig. 1, and pl. 40 A, fig. 1.

‡ Anderson describes *Anurosorex* as having a short symphysis pubis.

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ascertained (Jour. An. Phys. xx, p. 359) that there are no lower canines. The two front teeth in each jaw (median incisors) differ from all the others: in the upper jaw they are curved, and bear a more or less prominent posterior basal cusp; in the lower jaw they are long, they project horizontally forward, and are sometimes slightly curved upwards at the end. Behind the anterior pair of upper incisors come a variable number of small incisors and premolars, amongst which the small canines can be recognized only by their position immediately behind the premaxillary suture, which, however, is only visible in very young animals. The last premolar is large, and there are always three upper molars on each side, the hinder much smaller than the others. There are always 12 teeth in the lower jaw—4 incisors, 2 premolars, and 6 molars; whilst the number in the upper jaw varies from 14 to 20. Some genera are distinguished by having the teeth tipped with brown, in others the teeth are white throughout.

Shrews have the widest distribution of any family of Insectivora, being found throughout the temperate and tropical portions of Europe, Asia, Africa, and North America, with many of the adjacent islands.

The following account of the shrews of India is in great part derived from Mr. Dobson's notes, prepared for the third part (not yet published) of his Monograph of the Insectivora. The classification and most of the synonymy are his, and I am greatly indebted to him for the assistance he has given to me in dealing with one of the most difficult groups of Indian mammals.

A monograph of the Indian forms known to him was published by Blyth in 1855 (J. A. S. B. xxiv, p. 24), and Anderson has published two papers on the subject (P. Z. S. 1873, p. 227, and J. A. S. B. xlvi, pt. 2, p. 261).

The Indian genera of shrews may be thus distinguished:—

A. Teeth tipped with reddish brown .... SORICULUS.
B. Teeth entirely white.
  a. Tail without inferior fringe of white hairs: terrestrial.
    a'. 16 or 18 teeth in upper jaw; ear-conch and tail well developed .... CROCIDURA.
    b'. 14 upper teeth; ear-conch small; tail very short .... ANUROSOREX.
  b. Tail with an inferior fringe of white hairs: aquatic.
    a'. Ear-conch developed.................... CHIMARROGALE.
    b'. Ear-conch wanting .... NECTOGALE.

Genus **SORICULUS**, Blyth (1855).

Terrestrial. Ears small, hairy, more or less hidden by the fur. Tail hairy, but not provided with any scattered long hairs, nearly cylindrical and tapering very gently, greatly resembling that of a mouse. Fur soft and velvety.

Teeth tipped with reddish brown; this wears off to a great extent in old animals and sometimes disappears entirely, but traces can generally be detected: i. $\frac{3-3}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}=30$. Middle upper incisors with the anterior cusp bifid, the inner point short and small, lateral incisors and canine subequal in size, anterior premolar minute. Lower anterior incisors elongate, running back beneath the two next teeth and bearing a small projecting knob above, just in front of the next incisor; lower premolar bicuspid.

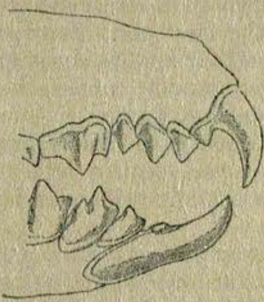

Fig. 63.—Incisors, canine, and premolars of *Soriculus nigrescens*. (Dobson, Mon. Ins., from an unpublished plate.)

Vertebræ: C. 7, D. 12, L. 6, S. 5, C. 17. The osteology is briefly described by Anderson in his Catalogue of the Mammalia. He shows that *Soriculus* presents some resemblance to *Talpa*, although the pelvis resembles that of *Crocidura*, not that of *Anurosorex*.

Soriculus is the only representative in India of the brown-toothed shrews, which are, with this exception, confined to the Palæarctic and Nearctic regions, and include *Sorex*, *Crossopus*, and *Blarina*.

Synopsis of Indian and Burmese Species.

A. Second upper incisor smaller than third; tail about half the length of the head and body.. *S. nigrescens*, p. 229.
B. Second upper incisor larger than third.
  a. Length of tail about equal to that of head and body .... *S. caudatus*, p. 230.
  b. Length of tail about half as much again as that of head and body.................. *S. macrurus*, p. 231.

114. **Soriculus nigrescens.** *The Sikhim brown-toothed Shrew.*

Corsira nigrescens, *Gray, A. M. N. H.* x, p. 261 (1842).
Sorex aterrimus, *Blyth, J. A. S. B.* xii, p. 928 (no description); xxiii, p. 733.
Soriculus nigrescens, *Blyth, J. A. S. B.* xxiii, p. 733; xxiv, p. 36: *Jerdon, Mam.* p. 59; *Anderson, Cat.* p. 204.
Sorex sikkimensis, *Hodgson, A. M. N. H.* ser. 2, iii, p. 203 (1849) (no description); xvi, p. 111 (1855); *Horsfield, Cat.* p. 136.

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Sorex oligurus *and* S. holosericeus, *Hodgs. Cat. Mam. &c. Nepal & Tibet B. M.* 2nd ed. 1863, pp. 8, 9 (no descriptions).

Tang-zhing, Lepcha; *Chika*, Newari.

Muzzle thickly furred. Ears small, hairy, completely hidden by the fur. Feet very thinly clad above and scaly. Claws long and straight, especially on the fore feet. Tail varying from one half of the head and body, or rather less, to about three fifths; round (or tetragonal), tapering very gently, thinly covered with short hairs, arising from between small scaly rings. Fur soft, dense, velvety.

The third upper incisor is a little larger than the second, the canine or third single-cusped tooth a little smaller. The minute fourth single-cusped tooth or first premolar is only just visible from the side.

Colour deep glossy brown, almost sooty black in some cases, dark glossy rufescent brown in others, almost the same throughout, scarcely paler below, a greyish tinge on the abdomen; basal three fourths of hairs leaden black. Feet brown above; tail dusky above, scarcely paler below.

Dimensions. In a large female, snout to vent 3·4 inches, tail 1·65, hind foot 0·54; in another specimen these measurements are 3, 1·82, and 0·55. Basal length of skull 0·8.

Distribution. This shrew has hitherto only been found in Sikhim and Nepal. It is common near Darjiling at elevations of about 4000 to 6000 feet, and perhaps higher. I learn from Mr. Dobson that he has received a *Soriculus* from Manipur, possibly referable to this species, but probably distinct, being smaller, with a proportionally longer tail. The genus will doubtless be found in the hills south of Assam.

Nothing is known of the habits of *S. nigrescens*; it is probably a burrower, living in the forest soil.

115. **Soriculus caudatus.** *Hodgson's brown-toothed Shrew.*

Sorex caudatus, *Hodgson, A. M. N. H.* ser. 2, iii, p. 203 (1849) (no description); *Horsfield, Cat.* p. 135 (1851).
Sorex leucops, *Hodgson, Horsf. A. M. N. H.* ser. 2, xvi, p. 111 (1855); *Jerdon, Mam.* p. 56.
Corsira caudata, *Blyth, J. A. S. B.* xxiv, p. 37.
Corsira alpina, *Tomes, A. M. N. H.* ser. 2, xvii, p. 27 (1856); *Blyth, Cat.* p. 86; *Jerdon, Mam.* p. 61.
Sorex homoürus?, *Hodgs. Cat. Mam. &c. Nepal & Tibet B. M.* 2nd ed. 1863, p. 8 (no description).
Soriculus gracilicauda, *Anderson, J. A. S. B.* xlvi, pt. 2, p. 282.
Soriculus caudatus, *Anderson, Cat.* p. 206.

Body shorter, but limbs longer proportionally than in *S. nigrescens.* Muzzle very thinly clad with hair. All the lower portions of the limbs nearly naked. Hind feet slender. Claws short. Tail long and slender, about the same lengthas the head and body, varying from a little less to a little more, round or tetragonal,

GSL

thinly clad with short bristly hairs. Ears hairy, partially hidden in the fur. The second upper incisor is distinctly larger than the third, which again exceeds the canine.

Colour brown, blackish to reddish, basal portion of fur dark leaden black.

Dimensions. Snout to vent, in one specimen, 2·46 inches, tail 2·57; in another, 2·35 and 2·15; hind foot 0·52; basal length of skull 0·66. According to Hodgson's measurements some individuals are as much as 3 inches from snout to vent.

Distribution. Sikhim, near Darjiling, and in the interior of the hills, but not, as Jerdon supposed, at a great elevation, the locality Kedam, whence, in Hodgson's MS. notes, *S. leucops* is said to have been brought, being only 6000 feet above the sea.

116. **Soriculus macrurus.** *The long-tailed Shrew.*

Sorex macrurus, *Hodgson, Cat. Mam. &c. Nepal & Tibet B. M.* 2nd ed. 1863, p. 9 (no description).

Body and limbs slender. Muzzle hairy, well clad. Limbs thinly furred. Tail round, thin, very long, about half as long again as the head and body together, thinly clad with short hair. Ears hairy, partially concealed by the fur, which is long and soft.

Second upper incisor distinctly larger than the third, which exceeds the canine in size in about the same proportion. Anterior upper premolar very small.

Colour uniform blackish brown, basal portion of hairs slaty.

Dimensions of an adult male from Darjiling: snout to vent 2·1 inches, tail 3·4, hind foot 0·57, ear from orifice 0·28, basal length of skull 0·58. Hodgson gives measurements of larger individuals, one 2·75 inches from snout to vent, tail 3·75, another 2·5 and 3·75.

Distribution. The types came from Darjiling; I once picked up in the station a dead specimen, that of which the measurements are given above. Hodgson's types appear to be lost, but his drawings and notes are sufficient for identification.

Genus **CROCIDURA**, Wagler, 1832.

Syn. *Pachyura*, Selys-Longchamps; *Feroculus*, Kelaart.

The head is long, the snout pointed, the sides of the muzzle more or less swollen and covered with numerous long vibrissæ; the nostrils open laterally. The eyes are small and nearer to the orifice of the ear than to the end of the snout. Ears of considerable size. The tail is well developed, and in most species tapering and clothed with short hairs, amongst which are scattered much longer hairs.

On each side of the body there is a gland varying greatly in development in different species, and absent in the females of some. The orifice of this gland is surrounded by short stiff hairs directed inwards. The secretion has a strong smell of musk and appears to be produced in much greater abundance during the rutting-season. In some of the smaller *Crocidura*, indeed, the gland cannot be detected at other times.

The genito-urinary and anal orifices both open into a shallow cloaca. There are 6 mammæ, all inguinal, and situated very far back. The sexes are often very difficult to distinguish if the mammæ are not developed, the male organ being retractile and the testes internal. The teeth are white throughout, the total number 28 or 30: i. $\frac{3-3}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{1-1 \text{ or } 2-2}{1-1}$, m. $\frac{3-3}{3-3}$. The anterior incisors are strongly hooked and have a basal cusp of moderate size; the next incisor on each side is larger than the two or three following teeth, the first two of which, the third incisor and the canine, do not differ greatly in size: whilst the anterior premolar is small in some species (*Pachyura*), absent in others (*Crocidura*); when present it is the smallest tooth in the jaw. All the teeth enumerated are conical except the first. The second premolar is a broad tooth with several cusps, and approaches the molars in shape.

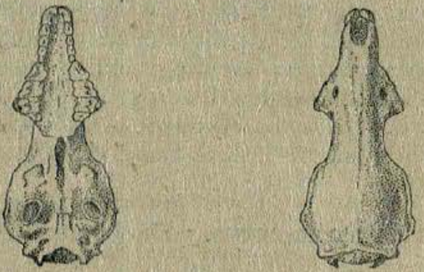

Fig. 64.—Skull of *Crocidura murina*.

This genus is widely spread in Asia, Africa, and Europe, and has several representatives in India, but the species are very variable and difficult to discriminate. One principal reason, besides variability, for the large number of nominal species in this genus lies in the fact that it is frequently impossible by external characters, and even by an examination of the teeth, to ascertain whether individuals are adult. The teeth are fully developed and the animals breed freely long before they attain their full growth. Most of the sutures of the skull, too, are anchylosed at an early age, the premaxillary suture (which in most mammals does not disappear before maturity) being closed in shrews at birth or very soon after. The best test of full growth in a shrew's skull is the anchylosis of the basi-occipital suture, lying just between the annular bullæ; the epiphyses of the limb-bones, too, would doubtless serve to show whether an animal is mature or not.

CSL

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Four small conical teeth, the hindmost very small, behind each anterior upper incisor. (*Pachyura.*)
  a. Size large, rarely in adults less than 4 inches from snout to vent *.
    a'. Ears almost naked, fore and hind claws subequal.
      a''. Feet brown above, hair on their upper surfaces brown .... *C. murina*, p. 233.
      b''. Feet flesh-coloured or yellowish white, naked or clothed with white hair .... *C. cærulea*, p. 236.
    b'. Ears covered with hairs; fore claws twice the size of hind claws .... *C. macropus*, p. 237.
  b. Size moderate, snout to vent 2·5 to 3·5 inches.
    a'. The hind foot from heel double the length of the fore foot from wrist .... *C. bidiana*, p. 238.
    b'. The hind foot about 1½ times the length of the fore foot.
      a''. Snout to vent * about 3·4 inches, hind foot 0·64 .... *C. rubicunda*, p. 239.
      b''. Snout to vent about 3 inches, hind foot 0·5 .... *C. leucogenys*, p. 239.
      c''. Snout to vent about 2·75 inches, hind foot 0·6 .... *C. dayi*, p. 240.
  c. Size very small, snout to vent rarely exceeding 2 inches.
    a'. Tail more than two thirds the length from snout to vent .... *C. hodgsoni*, p. 240.
    b'. Tail less than two thirds the length from snout to vent .... *C. perrotteti*, p. 241.
B. Three small conical teeth behind each anterior upper incisor. (*Crocidura.*)
  a. Tail very thinly clad with hair, scales distinct.
    a'. Snout to vent about 3 inches; tail and feet dark .... *C. fuliginosa*, p. 242.
    b'. Snout to vent 2 to 2¼ inches............ *C. horsfieldi*, p. 242.
  b. Tail well clad, scales concealed by the hair.
    a'. Fur dark throughout, or nearly so ...... *C. fumigata*, p. 243.
    b'. Fur of lower surface always pale and often white .... *C. aranea*, p. 244.

117. **Crocidura murina.** *The brown musk Shrew.*

Sorex murinus, *L. Syst. Nat.* ed. xii, p. 74 (1766).
Sorex myosurus, *Pallas, Act. Acad. Petrop.* 1781, pt. 2, p. 337, pl. iv (1785).
Sorex serpentarius, *Is. Geoffroy, Bélanger, Voy. Zool.* p. 119.
Sorex nemorivagus *and* soccatus †, *Hodgson, A. M. N. H.* (1), xv, p. 269 (1845).
Sorex murinus, griffithii, *and* niger, *Horsfield, Cat.* pp. 134, 135.
Sorex kandianus, montanus, *and* ferrugineus, *Kelaart, Prod.* pp. 30, 31.
Sorex saturatior, *Hodgson, A. M. N. H.* ser. 2, xvi, p. 110 (1855).

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* This measurement in shrews is always to the posterior margin of the anal orifice.

† The type sent under this name to the British Museum was *Soriculus nigrescens* (see Blyth, J. A. S. B. xxiii, p. 733, note).

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Sorex murinus, serpentarius, soccatus, nemorivagus, heterodon, niger, ferrugineus, *and* montanus, *Blyth, J. A. S. B.* xxiv, pp. 28–32.

Sorex serpentarius, viridescens, soccatus, *and* tytleri, *Blyth, J. A. S. B.* xxviii, pp. 284, 285.

Sorex albinus, murinus, griffithii, serpentarius, soccatus, heterodon, *and* niger, *Blyth, Cat.* pp. 83, 84.

Sorex murinus, nemorivagus, serpentarius, saturatior, tytleri, niger, *and* soccatus, *Jerdon, Mam.* pp. 54, 55, 56, 57.

Crocidura (Pachyura) blythii, pealiana, *and* blanfordii, *Anderson, J. A. S. B.* xlvi, pt. 2, pp. 264–269.

Crocidura murina *and* montana ?, *Anderson, Cat.* pp. 180, 193.

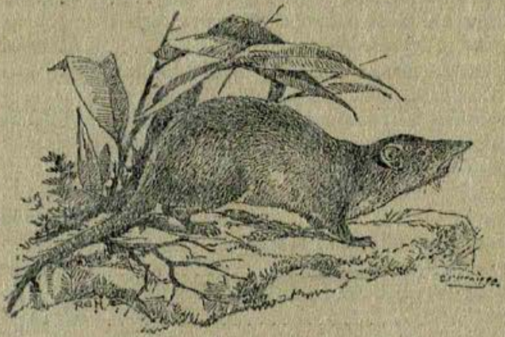

Fig. 65.—*Crocidura murina.* (From a drawing by Col. Tickell.)

Teeth in upper jaw 18. Size large, but varying considerably. Snout hairy, not much swollen at the sides. Ears large, rounded, almost naked or thinly clad with short hairs. Feet covered with hair above, the pes or hind foot from the heel about one and a half times the length of the manus or fore foot from the wrist; claws well developed, those of the fore and hind extremities differing but little in size. Tail thick at the base and tapering, varying from $\frac{3}{5}$ to $\frac{2}{3}$ the length of the head and body, thinly covered with short hair, amongst which a few very long hairs are interspersed. Fur of the body rather coarse. Lateral glands well developed, round.

The basal cusp of the anterior upper incisor, the third incisor, and the canine are of very nearly the same size; sometimes the canine is larger than the third incisor, sometimes the two are equal. As a rule, about half of the small first upper premolar is visible from the outside between the canine and the second premolar, but there is some variation. The second upper incisor is approximately of the same height as the middle cusp of the second or large premolar.

Colour either some shade of brown throughout, the lower parts being a little paler and greyer, and the basal portion of the fur dark slaty, or else dark ashy grey, sometimes blackish, with more or less developed ferruginous or brown tips to the fur. The brown form varies from light to very dark blackish brown. The ears, feet, and tail brown, the skin of those parts dusky, not flesh-coloured as in *C. cærulea.*

Dimensions. A large male from Nepal measured from snout to vent 5·5 inches, tail 3·4, height of ear from orifice 0·38, hind foot from heel (claws not included) 0·9. In a large female from Darjiling the corresponding dimensions were 5·3, 3·2, 0·43, and 0·78. In a smaller, perfectly adult, female from Mari (Punjab) the measurements were 4, 2·7, 0·4, and 0·72. With this and other species, it must be borne in mind, as already mentioned in the description of the genus, that immature specimens cannot be distinguished by their external characters.

Varieties. The common Himalayan form (*S. griffithi*, Horsf., and *S. saturatior*, Hodgson) is deep brown in colour, with longer and thicker hair than the form occurring in the plains of India. The latter is often lighter brown in colour (*Sorex tytleri*, Blyth, and *Crocidura blanfordi*, Anderson), but the deep rich brown variety is prevalent in Burma and the Malay countries and may be considered typical; the most important of the other varieties is the dark ashy grey type (*Sorex serpentarius*, *S. kandianus*, &c.), often with brown or ferruginous tips to the fur (*S. ferrugineus*). A blackish-brown variety has been named *S. niger*. It is possible that some of the names quoted above as synonyms of *C. murina* should have been referred to the next species, *C. cærulea*; but the latter is doubtfully distinct, and there can be no question that intermediate forms (probably hybrids) are met with. The type of *S. nemorivagus*, Hodgson, is an immature specimen. I doubt the distinctness of the small Ceylon shrew called *C. montana* by Anderson, and I am not convinced that it is the same form as *Sorex montanus* of Kelaart.

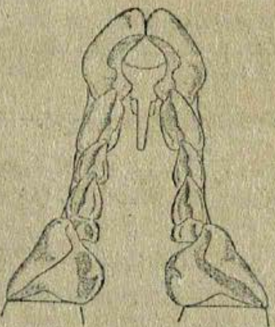

Fig. 66.—Upper incisors, canines, and premolars of *Crocidura murina*, var. *montana*, from below. (Dobson, Mon. Ins., unpublished.)

Distribution. Probably throughout the whole of India, Ceylon, Burma, and the Oriental Region generally; certainly throughout the Himalayas from Kashmir to Assam, up to an elevation of 7000 or 8000 feet, and in many parts of the Indian peninsula and Burma. Specimens are recorded from Calcutta, Ajmere, Khandála near Bombay, Malabar, and Madras, also from Ceylon, Assam, the Khási hills, Arakan, and Tenasserim, besides many parts of the Malay peninsula and archipelago, and from China.

Habits. The brown musk shrew is chiefly found in woods, but occasionally enters houses, and specimens have been captured about stables and similar buildings in some of the Himalayan stations. The musky smell, although very strong in adults, is not, as a rule, so powerful and offensive as that of *C. cærulea.* The food consists of various insects, larvæ, worms, and probably of any smaller mammal or bird. I have taken one in a rat-trap baited with meat.

The natives in parts of India regard this shrew as poisonous, but there is no foundation for the belief.

118. **Crocidura cærulea.** *The grey musk Shrew.*

Sorex cæruleus, *Kerr, An. King.* p. 207 (1792).
Sorex pilorides, *Shaw, Mus. Lever.* ii. p. 31 (1796), *nec* Mus pilorides, *Pallas.*
Sorex cærulescens, *Shaw, Gen. Zool.* i, p. 533 (1800); *Blyth, J. A. S. B.* xxiv, p. 25; *id. Cat.* p. 82; *Jerdon, Mam.* p. 53.
Sorex indicus *and* capensis, *Geoffr. Ann. du Mus.* xvii, pp. 183, 184 (1811).
Sorex sonneratii *and* giganteus, *Is. Geoffr. Mém. du Mus.* xv, pp. 132, 137 (1827).
Sorex myosurus, *Gray & Hardw. Ill. Ind. Zool.* i, pl. ix, *nec Pallas.*
Sorex murinus, *Hodgson, A. M. N. H.* (1) xv, p. 269 (1845); *Kelaart, Prod.* p. 30, *nec L.*
Crocidura (Pachyura) waldemarii, ceylanica, *and* media, *Peters, MB. Ak. Berl.* 1870, pp. 590, 591, 592.
Crocidura (Pachyura) fulvo-cinerea *and* sindensis, *Anderson, J. A. S. B.* xlvi, pt. 2, pp. 263, 266.
Crocidura cærulescens *and* beddomei, *Anderson, Cat.* pp. 171, 179.

Chachundar, H.; *Chundi*, Kol; *Sondeli*, Can.; *Kandeli*, Mal.; *Kunemiyo*, Cingalese; *Anachiwa-gagur*, Kashmiri; *Kywek-tsút*, Burmese; *Musk-rat*, of Anglo-Indians.

Upper teeth 18. This, the common musk shrew (or, as it is usually called, musk-rat) of India, only differs from *C. murina* in larger size and in coloration, and it is very doubtful if either of these distinctions is constant. The fur is short, the tail thick at the base, and both it and the feet very thinly clad with hair, a few scattered longer hairs on the tail.

Colour usually bluish grey, paler below, the fur sometimes with ferruginous brown tips, especially on the hinder part of the back. Occasionally specimens are found of a rufous-fawn tint above, grey below. Young specimens are dark slate-grey. Skin of the snout, ears, feet, and tail flesh-coloured, and hairs on the feet and tail white or nearly white.

Dimensions. A full-grown male measures about 6 inches from nose to vent, tail 3·5, hind foot 1, basal length of skull 1·4. Females are considerably smaller in general. A very large male measured about 7 inches from snout to vent, tail 5½. The tail varies in length considerably.

Varieties. Anderson classes as distinct varieties the form originally named by him *C. sindensis*, which is smaller than the typical

Bengal form, and also the var. *fulvo-cinerea*, from Assam and Arakan, equal in size to typical *C. cærulea*, but fawn-coloured above.

Distribution. India, Ceylon, and Burma, in towns and about human habitations; also in some of the other ports on the Indian Ocean, probably carried thither in ships. There is in the British Museum a specimen of a musk shrew, probably *C. cærulea* or *C. murina*, obtained on board ship by Sir John Kirk.

Habits. It appears doubtful whether this shrew is ever found away from human habitations, and Mr. Dobson has suggested to me the idea that *C. cærulea* is merely, like the cockroaches on which it feeds, a semi-domesticated variety, *C. murina* being the original wild type. I think this view very probable. It is, in some cases, very difficult to determine to which of the two forms specimens should be referred, and in all probability wherever they meet they breed together.

Like all other shrews, the common musk shrew is nocturnal, frequenting houses at night and hunting about rooms for cockroaches and other insects, uttering at times a sharp squeaking cry, and hiding during the day in holes, drains, &c. It is a harmless inoffensive animal, and does much service to man by destroying insects. Its diurnal haunts are liable to smell strongly of the secretion* from the lateral glands, but it does not communicate the smell to anything it merely passes over, unless it is disturbed or frightened.

The food of this shrew consists mainly of insects, but meat is occasionally eaten by it. Sterndale quotes from the 'Asian' an account of one that attacked a large frog, and McMaster met with another feeding upon a scorpion. The latter also relates that he has known this shrew to eat bread. It is commonly accused in India of feeding on rice and pulse; but experiments made by Anderson on individuals kept alive by him showed that they refused to touch any kind of grain, but devoured insects, especially cockroaches, freely, and he found no vegetable food of any kind in the stomachs of several he examined.

I can find nothing recorded as to the breeding-habits of this species. The young are born blind.

119. **Crocidura macropus.** *The long-clawed Shrew.*

Sorex macropus, *Blyth, J. A. S. B.* xx, p. 163 (1851).
Corsira newera ellia, *Kelaart, A. M. N. H.* ser. 2, viii, p. 338 (1851).
Feroculus macropus, *Kelaart, Prod.* p. 32; *Blyth, J. A. S. B.* xxiv, p. 35.

Upper teeth 18. Size moderately large; tail tapering, thinly clad, with longer hairs intermixed; feet large, the fore feet with very large claws, which are nearly twice as long as those on the hind feet. Fur moderately long and soft. Ears small, hairy, scarcely visible beyond the fur. Upper surface of the feet hairy.

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* The absurd story that wine or beer becomes impregnated with a musky taste in consequence of this shrew passing over the bottles (a story related with implicit faith, together with many other marvellous fables, by the naturalists of the last century) is less credited in India than it formerly was, owing to the discovery that liquors bottled in Europe and exported to India are not liable to be tainted.

Lower front incisors slightly serrated above. The dentition generally is very similar to that of *C. murina.*

Colour dark slaty grey above, with rufous-brown tips to the hair of the back, below rather paler; tail and feet dark; in the type specimen the tip of the tail was whitish. Claws white.

Dimensions. Head and body 4¼ inches, tail 2⅓, hind foot with claws ⅞, claw of middle finger ¼ inch long according to Blyth. A not quite mature female in spirit measures:—snout to vent 3·5 inches, tail 2·25, hind foot (without claws) 0·65, middle fore claw 0·2, height of ear from orifice 0·3.

Distribution. This well-marked shrew was first found by Kelaart at Nuwera Ellia, in Ceylon. Recently a specimen has been received at the British Museum from the Palni hills in Southern India.

Habits. Kelaart suggests that *C. macropus* may be a water-shrew; but there is nothing apparent in the structure to support this view. The long fore claws do not appear particularly adapted for digging. A shrew belonging to this species was kept alive by Kelaart for some time and fed upon earthworms.

120. **Crocidura bidiana.** *Bidie's Shrew.*

Crocidura (Pachyura) bidiana, *Anderson, J. A. S. B.* xlvi, pt. 2, p. 276 (1877); *id. Cat.* p. 185.

Crocidura (Pachyura) stoliczkana, *Anderson, J. A. S. B.* xlvi, pt. 2, p. 270.

Upper teeth 18. This is very like a small *C. murina*, but is distinguished by the pes or hind foot from the heel being double the length of the manus or fore foot from the wrist, instead of only one and a half times the length, as in all allied forms. Ears moderate, round, and rather hairy. Tail long, not much swollen at the base. Fur long, fine, and dense. Through the remarkably wide space between the canine and the second premolar nearly the whole of the small first premolar is visible. There is a small tubercle inside the basal cusp of each anterior upper incisor.

Colour reddish brown above and below, the under surface with a greyish gloss, basal portion of all hairs dark slaty. Snout, ears, and feet pale reddish brown, tail darker.

Dimensions of a nearly adult male: snout to vent 3·2 inches, tail 2·6, hind foot 0·8, height of ear 0·37.

Distribution. The type was from Madras, and a young specimen from Bombay, originally distinguished as *C. stoliczkana*, was afterwards referred to this species by the describer.

The description is taken from Anderson's and from some notes given to me by Dobson. I have not examined the specimens.

121. **Crocidura rubicunda.** *The Pareshnáth Shrew.*

Crocidura (Pachyura) rubicunda, *Anderson, J. A. S. B.* xlvi, pt. 2, p. 277 (1877); *id. Cat.* p. 190.

Upper teeth 18. Size moderate. Snout long, pointed, hairy. Ears large, round, very sparsely haired: rather long white hairs on the flaps. Feet slender, covered with short, nearly white hairs. Tail slightly swollen at the base, round, and rather thinly clad with longish pale yellow, almost white hairs, long white hairs being intermingled. Fur rather long and soft. Lateral gland small, but distinct.

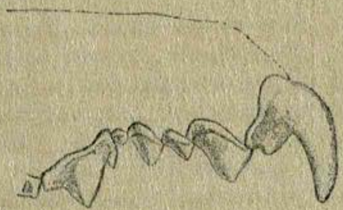

Fig. 67.—Anterior upper teeth of *Crocidura rubicunda.* (Dobson, Mon. Ins., unpublished.)

No tubercle inside the basal cusp of the anterior upper incisor. First premolar largely visible from outside, between the canine and second premolar.

Colour pale rusty fawn above, grey suffused with fawn below, all the basal portions of the hairs dark slaty; muzzle, ears, feet, and tail pale yellowish.

Dimensions of an adult female: snout to vent 3·4 inches, tail 2·3, hind foot 0·64, height of ear 0·33, length of skull 0·93.

Distribution. The only known locality is Pareshnáth hill, east of Hazáribágh, in Bengal.

This species is very nearly allied to *C. bidiana*, but differs in having much smaller and shorter feet. The above description, like the last, is taken from Anderson's and Dobson's notes.

122. **Crocidura leucogenys.** *The white-cheeked Shrew.*

Crocidura leucogenys, *Dobson, A. M. N. H.* ser. 6, i, p. 428 (1888).

Upper teeth 18. Size moderate. Snout hairy. Ears nearly naked. Feet hairy above; claws of moderate size. Tail thick, gradually tapering, covered with hair of moderate length, with longer hairs interspersed. Fur short. A large lateral gland.

The upper canine and second premolar are only separated by a short interval outside, through which a portion of the first premolar is visible. No inner process to basal cusp of first upper incisor.

Colour light sandy rufescent brown above, whitish grey below. Cheeks pale-coloured. Hair nearly the same colour throughout, that on the back a little paler towards the base. Tail light sandy brown above, whitish below.

Dimensions of the type, an old female with worn teeth: snout to vent 3 inches, tail 2, hind foot 0·5, basal length of skull 0·75.

Distribution. But a single specimen is known; this was obtained by Sir O. B. St. John in Ajmere.

This species is near *C. rubicunda*, but smaller in all its dimensions.

123. **Crocidura dayi.** *Day's Shrew.*

Crocidura dayi, *Dobson, A. M. N. H.* ser. 6, i, p. 438 (1888).

Upper teeth 18. Size rather small. Snout hairy. Ear not large, nearly naked. Feet thinly covered with hair above. Tail long, thinly covered with short hairs (no longer hairs interspersed in the solitary specimen known). Fur long and close.

There is a distinct pointed internal lobe, posteriorly situated, to the basal cusp of each anterior upper incisor. The first or small premolar is (in the type) unusually large, but little inferior to the third incisor in section, though less high; the height, however, exceeds that of the anterior cusp of the second premolar. Lower anterior incisors serrated above.

Colour deep rich brown above, slightly paler and greyer below; the basal two thirds of all hairs blackish. Feet and tail dark.

Dimensions. Hind foot without claws 0·6 inch, basal length of skull 0·67. The length of the head and body in a dried skin is about 2¾ inches; tail approximately the same, but no dependence can be placed on these measurements.

Distribution. The only specimen known is a dried skin with a skull in the British Museum. This skin was obtained by Dep. Surgeon-General F. Day in the Madras Presidency, and in all probability from the Palni or Travancore hills.

The hind foot is longer than in *C. leucogenys*, although the skull is smaller.

124. **Crocidura hodgsoni.** *The Himalayan pigmy Shrew.*

Sorex pygmæus, *Hodgson, A. M. N. H.* xv, p. 269 (1845), *nec Pallas.*
Sorex pygmæus, micronyx, hodgsoni, *and* atratus, *Blyth, J. A. S. B.* xxiv, pp. 32, 33, 34; *id. Cat.* p. 85.
Sorex hodgsoni *and* micronyx, *Jerdon, Mam.* pp. 57, 58.
Crocidura (Pachyura) pygmæoides, *Anderson, J. A. S. B.* xlvi, pt. 2, p. 279; *id. Cat.* p. 194.

Chupechi, Bhot.

Upper teeth 18. Size very small, but larger than that of *C. perrotteti*. Ears large, nearly naked. Tail about three quarters the length of the head and body, or more, thinly clad with short hair, amongst which long hairs are scattered. Feet with short hair above. Lateral gland only developed at the rutting-season, when it becomes large.

Colour brown, varying from light sandy to dark and almost black; lower parts paler, the extreme tips of the hairs on the underparts, especially on the throat, greyish.

Dimensions of a large female: snout to vent 1·85 inches, tail 1·4, hind foot 0·37, height of ear 0·2, basal length of skull 0·5. Other specimens are somewhat smaller.

Distribution. Probably throughout the Himalayas and in the ranges south of the Assam valley. I cannot, however, find any locality recorded west of Mussooree. Dobson refers to the same form a specimen of a pigmy shrew from Ajmere, and another from Sind.

125. **Crocidura perrotteti.** *The Indian pigmy Shrew.*

Sorex perrotteti, *Duvernoy, Mag. Zool.* 1842, p. 29, pl. 47.
Sorex melanodon, perrottetii, *and* nudipes, *Blyth, J. A. S. B.* xxiv, pp. 33, 34; *id. Cat.* pp. 84, 85.
Sorex perrotteti *and* melanodon, *Jerdon, Mam.* p. 58.
Pachyura assamensis, *Anderson, P. Z. S.* 1873, p. 234.
Crocidura (Pachyura) macrotis, nitidofulva, nilgirica, *and* travancorensis, *Anderson, J. A. S. B.* xlvi, pt. 2, pp. 271–275.
Crocidura macrotis, perrotteti, *and* travancorensis, *Anderson, Cat.* pp. 186–189.

Upper teeth 18. Size very small. Ears large, covered with very short hair. Feet thinly clad above. Tail not swollen at the base, thin, tapering towards the end, about two thirds the length of the head and body, or rather less, sparsely covered with very short hairs, amongst which longer hairs are scattered. Fur short. Lateral glands well developed.

Colour reddish brown to dark brown, nearly black above, paler and greyer below. Tail dark above, light-coloured beneath.

Dimensions of an adult male: snout to vent 1·78 inches, tail 1·12, hind foot 0·35, height of ear from orifice 0·15, basal length of skull 0·45.

Distribution. Southern India, especially the Nilgiri hills and Travancore, Bengal, Assam, and Tenasserim. Not reported from Ceylon.

Habits. Nothing has been recorded about this, one of the very smallest of all Mammalia. In a female Anderson found five fœtuses.

This species Dobson considers doubtfully distinct from the South European *C. etrusca.* I cannot help suspecting either that *C. hodgsoni* is not really different from *C. perrotteti*, or else that the number of Indian pigmy shrews must be more than two. The geographical distribution of these two forms, as given above, is quite anomalous.

Another shrew belonging to the section with 18 upper teeth has been described by Anderson under the name of *C. subfulva* (J. A. S. B. xlvi, pt. 2, p. 278; Cat. p. 192). The types are, however, immature, and it is quite uncertain what the adults may prove to be. Two specimens were found in Cutch by Dr. F. Stoliczka; the older of the two measures: snout to vent 1·9 inches, tail 1·3, hind foot 0·42, basal length of skull 0·62. Colour pale fawn above, silvery grey below.

126. Crocidura fuliginosa. *Blyth's Shrew.*

Sorex fuliginosus, *Blyth, J. A. S. B.* xxiv, p. 362; *id. Cat.* p. 84.
Crocidura rubricosa *and* kingiana, *Anderson, J. A. S. B.* xlvi, pt. 2, pp. 280, 281.
Crocidura rubricosa *and* fuliginosa, *Anderson, Cat.* pp. 196, 197.

Upper teeth 16. Size rather small. Muzzle thinly clad. Ears large, nearly naked. Feet thinly clad above. Tail long, three fourths the length of the head and body, or more, subcylindrical, very gently tapering (except in the rutting-season, when the basal portion is thickened), nearly naked, being thinly clad with very short hair, amongst which a few longer hairs are interspersed in the basal half only. Lateral gland small and elongate, present in the male only. The small first premolar is wanting, but otherwise the teeth, though much smaller, are similar to those of *C. murina*.

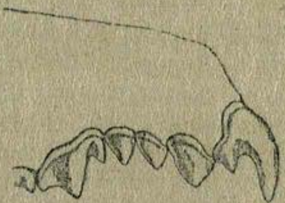

Fig. 68.—Anterior upper teeth of *Crocidura fuliginosa.* (Dobson, Mon. Ins., unpublished.)

Colour deep rich reddish brown above, ashy brown to ashy grey below, basal half of fur throughout slaty. Tail and upper surface of feet dark brown.

Dimensions. An adult male measures: snout to vent 3·1 inches, tail 2·7, hind foot 0·55; an old female, 2·9, 2 5, and 0·57. Basal length of skull in each 0·75.

Distribution. Eastern Himalayas, at an elevation not exceeding 5000 or 6000 feet, Assam, and Tenasserim. Common in Sikhim.

127. Crocidura horsfieldi. *Horsfield's Shrew.*

Sorex horsfieldi, *Tomes, A. M. N. H.* ser. 2, xvii, p. 23 (1856).
Crocidura retusa, *Peters, MB. Akad. Berl.* 1870, p. 585; *Anderson, Cat.* p. 199.

Upper teeth 16. Size small. Muzzle thinly clad. Ears of moderate size, nearly naked. Feet thinly clad above; of the proximal pair of pads on each hind foot the outer is further from the heel. Tail thick at the base and tapering, but little shorter than the head and body, thinly clad with short hair, a few longer hairs interspersed in the basal half only. Lateral gland large, nearly circular, present in both sexes, but less developed in females than in males.

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Colour bright ferruginous brown above, light yellowish grey below, basal portion of the fur light grey. Some specimens are reddish brown above, light brown below, with the basal portion of the hairs slaty. Feet and tail flesh-coloured in many cases, but dusky in others.

Dimensions. Snout to vent in a large female 2·25 inches, in a male 2·1, tail 2 and 1·95, hind foot 0·45, basal length of skull 0·6.

Distribution. This species has hitherto only been found in Ceylon, where, however, it escaped the notice of Kelaart. Specimens have been sent from Paradinia, so this form is probably an inhabitant of the hills. It should be looked for in the Travancore ranges also.

128. **Crocidura fumigata.** *De Filippi's Shrew.*

Sorex (Crocidura) fumigatus, *De Fil. Arch. per la Zool. Genova*, ii, p. 379; *id. Viag. in Persia*, p. 343; *Blanford, Eastern Persia*, ii, p. 24.

Upper teeth 16. Size small. Muzzle thickly clad with hair. Ears of moderate size, nearly naked. Feet thinly clad above, proximal pair of pads on hind foot parallel in the only specimen I have access to, that from Simla; in all other species the outer of the two is much more distant from the heel. Tail remarkably thick in the male, thin in the female, about two thirds the length of the head and body, well clad with coarse hair of moderate length throughout, with long fine hairs interspersed on the basal half. A small pencil of hair at the end of the tail. No lateral gland has been detected.

Colour reddish brown above, greyish brown below, basal portion of fur on both surfaces slaty. Tail dark brown throughout, feet paler brown above.

Dimensions. Snout to vent 2·75 inches, tail 1·9, hind foot 0·55.

Distribution. Originally described from Northern Persia. Mr. Dobson tells me he has seen specimens from Kiangsi, and he has identified with this form a shrew sent to me by Mr. Hume from Simla.

129. **Crocidura aranea.** *The spider Shrew.*

Sorex araneus, *L. Syst. Nat.* ed. xii, p. 74, *partim*; *Schreber, Säugeth.* iii, p. 573, pl. 160.
Sorex russulus *and* leucodon, *Herm. Zimm. Geog. Gesch.* ii, p. 382.
Sorex myoides, *Blanford, J. A. S. B.* xliv, pt. 2, p. 106; *id. Yark. Miss., Mam.* p. 16, pls. i, i *a*.

Upper teeth 16. Snout, upper surface of feet, and tail fairly clad with hair, the latter not swollen at the base, nearly cylindrical, about half as long as the head and body, or rather more, covered with rather short hair, with a few long hairs intermixed. Lateral gland small and elongate in males, wanting in females.

Colour brown above, usually fawn-coloured or greyish brown;

below pale grey or white; fur slaty at the base throughout; upper surface of tail darker than the lower.

Dimensions of an adult Ladák female: snout to vent 2·1 inches, tail 1·5, hind foot 0·5, extreme length of skull 0·75.

Distribution. Central and Southern Europe, Northern Africa, and Central Asia, extending to North-eastern Siberia. It has been obtained in Ladák.

Habits. In Europe this shrew is commonly found about cultivated ground and is often met with in houses. It lives on insects, worms, young mammals of small size, and young birds, and will eat meat and fat. It has from 5 to 10 young, which are born in summer, and which attain their full growth in about 6 weeks.

Sorex kelaarti, Blyth, J. A. S. B. xxiv, p. 32; Cat. Mam. p. 84 (*Crocidura kelaarti*, Anderson, Cat. Mam. p. 200), is founded, Mr. Dobson informs me, on a very young female, with the teeth imperfectly grown, although the inguinal teats are fully developed. Despite the circumstance that there are but 28 teeth, this shrew may be a young specimen of *C. murina*. The small premolars are wanting in a half-grown skull of that species from Darjiling.

Genus **ANUROSOREX**, A. Milne-Edwards (1870).

Syn. *Pygmura*, Anderson (1873).

Head large in proportion to the body. Eyes very small. No external ear-conch; ears valvular. Feet short, scaly. Tail very short, naked, and scaly. Fur dense, velvety.

Teeth entirely white; there are 14 in the upper jaw, only two conical teeth lying between the upper anterior incisor and the single multicuspidate premolar on each side: i. $\frac{2-2}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}=26$.

A full description of the skull and skeleton is given by Anderson (An. Zool. Res. p. 151). The structure of the pelvis shows some resemblance to that of *Talpa*.

Two species are known, one of which occurs in Assam.

130. **Anurosorex assamensis.** *The Assam short-tailed Shrew.*

Anurosorex assamensis, *Anderson, A. M. N. H.* 1875, ser. 4, xvi, p. 282; *Anat. Zool. Res.* p. 150, pl. v, figs. 1–16 (skeleton); *id. Cat.* p. 171.

Snout semi-nude. Feet naked, scaly, the hind foot from the heel 1½ times the length of the fore foot from the wrist. Tail about one-sixth the length of the head and body, naked and scaly. Numerous thicker hairs project beyond the velvety fur, which is nearly erect on the skin (as in moles), and is longest on the rump, so as to conceal the greater part of the tail.

The skull is nearly half as long as the vertebral column from the atlas to the end of the sacral vertebræ. There is a distinct inner

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talon to the basal cusp of each upper anterior incisor. The outer upper incisors are larger than the canines. The anterior lower incisors are long and their points turn upwards; they are not serrated above.

Colour dark slaty, faintly washed with brownish rusty on the hairs of the rump; the longer hairs brown, with obscure pale tips. Snout, limbs, and tail flesh-coloured; claws yellow. The fur exhibits violet iridescence when wet.

Dimensions of a female: snout to vent 2·92 inches, tail 0·5, basal length of skull 0·92. Another specimen is 3·1 inches from snout to vent, tail 0·5, hind foot without claws 0·62.

Distribution. The only specimens known (a female and young) were obtained by Mr. S. E. Peal between Sibságar and Jaipur, in Assam.

Habits. This is probably from its structure a burrower, with habits similar to those of a mole.

An allied species, *A. squamipes*, the type of the genus, occurs in Eastern Tibet and Se-chuan. In this the tail is still shorter than in the Assam form.

Genus **CHIMARROGALE**, Anderson (1877).

Form adapted for an aquatic life. Ear-conch present but small. Feet scaly, broad, with a fringe of short coarse flat white hairs along their margins and on each side of every toe. Toes not webbed. Tail long, the under surface covered with white hairs, similar to those that fringe the feet.

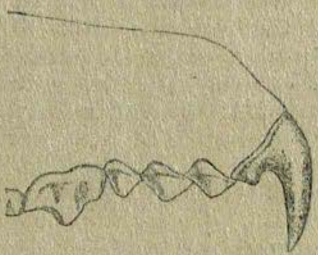

Fig. 69.—Anterior upper teeth of *Chimarrogale himalayica*. (Dobson, Mon. Ins., unpublished.)

Teeth white. Dentition: i. $\frac{3-3}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}=28$, as in *Crocidura*.

Two species are known, one being found in the Himalayas. The osteology is described by Anderson in his 'Anatomical and Zoological Researches.'

131. **Chimarrogale himalayica.** *The Himalayan Water-Shrew.*

Crossopus himalayicus, *Gray, A. M. N. H.* x, p. 261 (1842); *Blyth, J. A. S. B.* xxiv, p. 37; *Jerdon, Mam.* p. 60.
Crocidura himalaica, *Anderson, P. Z. S.* 1873, p. 231.

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Chimarrogale himalayica, *Anderson, J. A. S. B.* xlvi, pt. 2, p. 262; *id. An. Zool. Res.* p. 130, pl. v, figs. 17-30 (skeleton); *id. Cat.* p. 208.

Ung lagniyu, Lepcha; *Chupitsi*, Bhutia.

Snout densely furred and with numerous vibrissæ. Eyes very minute. The small ear-conch is hairy and entirely concealed by the fur. Feet scaly; toes naked; upper surface of metacarpus and metatarsus thinly clad with short flat bristly hairs. Tail thinly clad above, thickly below, with short flat hairs. Fur soft and dense, with a few longer hairs on the back and sides, becoming numerous on the rump.

Upper anterior incisors each with a lateral expansion on the inner side of the anterior cusp so as to meet, the proximal surface of the cusp being concave; the notch between the anterior and basal cusp very deep. The three intermediate conical teeth on each side nearly of equal size. Premolar about equal in section to the anterior molar, and having the inner ridge of the crown divided into two cusps. In the lower jaw the anterior incisors are elongate and much turned up at the end, and the crown of the premolar distinctly bifid at the summit.

Colour dark slaty grey above, with the tips of the hairs rich blackish brown, the terminations of the scattered longer hairs shining white. Lower parts pale brownish grey, basal portion of hair ashy grey below, dark leaden grey above. Hair on the upper surface of the feet brown. Tail dark brown above, white below.

Dimensions. An adult female measured: snout to vent 4·35 inches, tail 3·05, hind foot without claws 0·75, height of ear from orifice 0·27. Jerdon gives larger measurements, head and body 5 and 6 inches, and I possess skins that measure this. The skull of a small female measured 0·94 inch in basal length.

Distribution. South-eastern Himalayas, and the Khakhyen hills north of Burma, at elevations, so far as is known, of from 3000 to 5000 feet. Not recorded further west than Sikhim, where it is not rare.

Habits. The Himalayan water-shrew inhabits the banks of streams, and has been observed by Anderson running over the stones in the stream-bed and plunging freely into the water. It doubtless swims well. It is said to feed on water insects, aquatic larvæ, tadpoles, small fish, &c., like *Crossopus fodiens* of Europe.

The other species of this genus, *C. platycephalus*, inhabits Japan. A black shrew was noticed swimming in water by Col. McMaster near Nagpur, but no specimen collected (see 'Notes on Jerdon's Mammals,' appendix, p. 215). The animal is probably an undescribed form.

Genus **NECTOGALE**, A. Milne-Edwards (1870).

Aquatic. No external ear-conch; ears valvular. Feet large, broad, scaly, fringed with coarse white hairs; toes webbed; pads

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on the soles of the feet enlarged into broad disks. Tail long, with fringes of white hairs on the sides and lower surface and on the terminal portion of the upper surface; last third of tail compressed.

Teeth white: i. $\frac{3-3}{2-2}$, c. $\frac{1-1}{0}$, pm. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}=28$, as in *Crocidura*.

This is a more thoroughly aquatic form than its near ally *Chimarrogale*. Only one species is known.

132. **Nectogale elegans.** *The Tibetan Water-Shrew.*

Nectogale elegans, *A. Milne-Edwards, Comptes Rendus*, lxx, p. 341 (1870); *id. Rech. Mam.* p. 266, pls. 39, 39 A; *W. Blanford, P. A. S. B.* 1875, p. 198.

Eye very small. Snout covered with fur as thick as that on the body. Hind feet large and broad, double the length of the fore feet, naked above, only the terminal phalanges free from the web and fringed with hairs like those on the sides of the feet, white, coarse and flattened, and nearly $\frac{1}{10}$ inch long, or twice the length of those in *Chimarrogale*. A few scattered coarse hairs on the upper surface of the metacarpus. Hair fringing the fore feet short, and no fringes to the toes, but the disks beneath the sole are similar to those on the hind feet. Tail well clad above with short flat hairs, densely clad with similar flat hairs below, which form fringes. There is one along each side of the basal third of the tail, the two unite and form a median inferior fringe for the remaining two thirds, along each side of which is a lateral fringe, dying out towards the end, where the tail is distinctly compressed, whilst on the terminal portion there is an upper median fringe. Fur extremely dense, soft, and long, evidently adapted for a cold climate, with conspicuous longer hairs on the back and sides, becoming most numerous on the rump.

Colour rich dark brown above, the longer hairs glistening white; upper lip, chin, throat, and breast whitish, passing into light brown on the abdomen and flanks, but the line of division well marked in front of the fore limbs. Tail whity brown above, white below. The fur when wet is iridescent.

Dimensions. Head and body 3·6 inches, tail 4, hind foot 1, extreme length of skull 1.

Distribution. Tibet. First found by Père David in Eastern Tibet, then a specimen was procured by Mr. Mandelli from the Sikhim frontier. I once saw a small mammal, probably this species, swimming in a deep stream at 15,000 feet above the sea, near Momay Samdong in Sikhim. This shrew is evidently an inhabitant of high elevations, and may hereafter be found in other parts of the high Himalayas and Tibet.

Habits. Evidently *Nectogale*, from its structure, is thoroughly aquatic. The enlarged disk-like pads of the feet are believed by A. Milne-Edwards to be employed as suckers, and to enable the animal to hold on to smooth rocks or stones in a stream-bed.

Suborder *DERMOPTERA*.

This suborder contains but a single family, represented by only one genus. The connexion with the Insectivora is not very obvious, and the view, already noticed, that the Dermoptera should rank as a distinct order has much in its favour.

Family GALEOPITHECIDÆ.

Genus **GALEOPITHECUS**, Pallas (1780).

It will be convenient to give all the characters of this anomalous mammal under the head of the genus. The flying lemurs, as they are called, are animals about the size of a small domestic cat, having a rather long head, well-developed tail, and slender limbs.

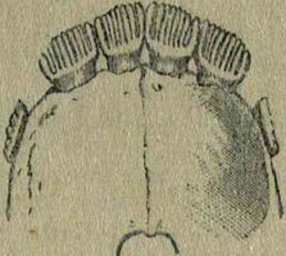

Fig. 70.—Lower incisors of *Galeopithecus*. (Guide to the Galleries of Mammalia, British Museum, 1885.)

An expansion of the skin connecting the limbs begins from the side of the throat, extends all along the neck, body, and tail to the tip, and forms a web between all the toes which are included in it to the base of the claws. The whole forms a parachute, by the aid of which the animal glides from tree to tree. Something similar is found in flying squirrels and in some other mammals and a few lizards, but in none is it so fully developed as in the present genus.

Dentition: i. $\frac{4}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. The upper incisors are quite at the side, all the terminal portion of the upper jaw being toothless. The anterior pair of incisors are compressed and subpectinate, with one root. The second incisor and the canine are similar to each other in shape, both being compressed and two-rooted, with a triangular crown terminating in a median point. Premolars and molars three-rooted. Anterior premolar with two principal cusps. Second premolar and all the molars similar in shape: the crown semioval in section, with the convex side inwards, and sharply tuberculate around a central hollow.

Lower incisors pectinate, the two median pairs very deeply cleft like combs; outer pair much less deeply cut. Lower canine and anterior premolar much like upper canine; second premolar elongate and tuberculate; lower molars very similar to the upper, but with the convexity towards the outside of the jaw.

Skull broad, muzzle rounded and blunt, rim of orbits projecting, postorbital processes broad, zygomata strong; palate terminating posteriorly in a median point, from which a ridge runs backwards in continuation of the narial septum and divides the mesopterygoid fossa. The bullæ are completely ossified.

The radius and ulna are united distally, the tibia and fibula distinct throughout. The vertebral formula is: C. 7, D. 13–14, L. 5–6, S. 5, C. 15–17.

The ears are rounded and of moderate size. The feet have a naked, very flat, non-tuberculate sole. Claws sharp, much compressed, and curved. Mammæ 4, all pectoral. There is a large cæcum.

This remarkable animal has been referred by different naturalists to the bats and lemurs; but it has really no affinity with the former, and but little with the latter, from which it is separated by the form of its brain, the structure of the skull and teeth, and the deciduate discoidal placenta.

Two species are known—one, *G. philippinensis*, peculiar to the Philippine Islands; and the original type, *G. volans*.

133. **Galeopithecus volans.** *The flying Lemur.*

Lemur volans, *L. Syst. Nat.* i, p. 45 (1776).
Galeopithecus volans, *Pall. Acta Acad. Sc. Petrop.* iv. p. 208, pls. vii, viii (1780); *Horsf. Cat.* p. 26; *Blyth, J. A. S. B.* xxi, p. 433, xxii, p. 411; *id. Cat.* p. 19.
Galeopithecus temminckii, *Waterhouse, P. Z. S.* 1838, p. 119; *Cantor, J. A. S. B.* xv, p. 177.

Kubong, Malay.

Fur short, very fine and soft. Canines and the outer upper incisor and first lower premolar with low crowns. Anterior upper incisors trilobate (sometimes with four lobes).

Colour above varying from dark greyish brown to pale chestnut, always overlaid, mottled, and blotched with silvery white; lower parts light brown, more or less rufous. Younger animal much variegated, and with well-defined white spots on the side. The dorsal fur is generally (not always) dusky at the base; the greater part of the length is whitish, a subterminal ring blackish brown (varying to chestnut), and the tip white.

Dimensions. A male measured, head and body 16 inches, tail 9. A skull is 2·75 inches long in basal, 2·9 in extreme length, zygomatic breadth 2.

Distribution. The Malay peninsula, extending north to Mergui in Tenasserim, where it was obtained by Capt. Berdmore, and to Siam, also Sumatra, Java, and Borneo.

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Habits. This species is of course arboreal, and by means of its parachute can throw itself from one tree and glide through the air to another at a considerable distance. Wallace relates that he saw one pass from one tree to another 70 yards distant, with a fall of only one in five; and he remarks that the animal must have some power of guiding itself in the air, as otherwise it could not alight on the trunk of the tree to which its flight is directed. It is entirely nocturnal in its habits, and is said to remain hanging on the stem or branch of a tree head downwards during the day, its peculiar mottled coloration being very similar to that of the bark.

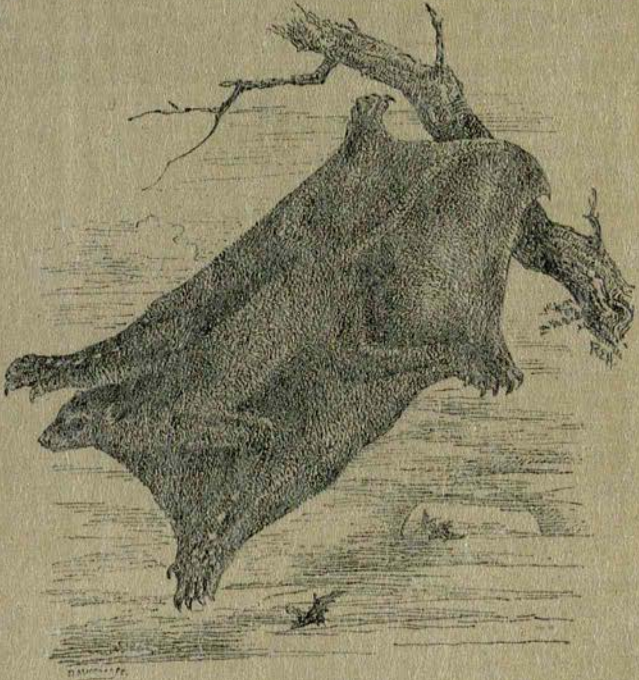

Fig. 71.—*Galeopithecus volans.* (From a drawing by Col. Tickell.)

Galeopithecus is said to be purely herbivorous, feeding on leaves and fruits. It has but one young one at a time.

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Order CHIROPTERA.

Volant mammals, having their fore limbs specially modified for flight. The forearm consists of a rudimentary ulna, a long curved radius, and a carpus of six bones supporting a thumb and four greatly elongated fingers, between which, the sides of the body, and the hinder extremities a thin expansion of the integument (the *wing-membrane*) is spread out. The knee is directed backwards, owing to the rotation of the hind limb outward by the wing-membrane; a peculiar elongated cartilaginous process (the *calcaneum*), rarely rudimentary or absent, arising from the inner side of the ankle-joint, is directed inwards and supports part of the posterior margin of an accessory membrane of flight, extending from the tail or posterior extremity of the body to the hinder limbs (the *interfemoral membrane*). The penis is pendent, the

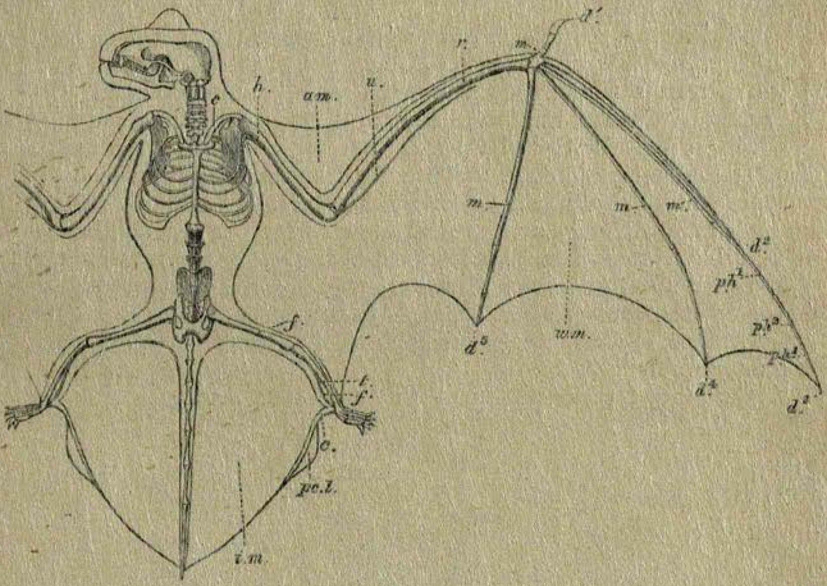

Fig. 72.—Skeleton and Volar Membranes of the Noctule (*Vesperugo noctula*), half nat. size. (Flower, Art. Mammalia, 'Encyclopædia Britannica.')

c., clavicle; *h.*, humerus; *r.*, radius; *u.*, ulna (rudimentary); *d.'*, first digit or pollex; $d.^2$, $d.^3$, $d.^4$, $d.^5$, other digits supporting *w.m.*, the wing-membrane; *m.*, *m.*, metacarpal bones; $ph.^1$, $ph.^2$, $ph.^3$, first, second, and third phalanx of third digit; *am.*, antebrachial membrane; *f.*, femur; *t.*, tibia; *f.*, fibula (rudimentary); *c.*, calcaneum or calcar supporting *i.m.*, the interfemoral membrane; *pc.l.*, post-calcaneal lobe.

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testes abdominal or inguinal; the mammary glands thoracic, and generally post-axillary; the uterus simple or two-horned; the placenta discoidal and deciduate; and the smooth cerebral hemispheres do not extend backwards over the cerebellum. The dental series consists of four kinds of teeth: incisors, canines, premolars, and molars; and the dental formula never exceeds i. $\frac{4}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$, = 38 teeth (*Dobson*).

Besides the "wing-membrane" and "interfemoral membrane," there is a smaller membrane in front of the humerus and forearm called the "antebrachial membrane." The relative position of the different membranes, and of the bones supporting the wing-membrane, is shown in the accompanying woodcut (fig. 72). The manus or hand is always composed of five digits; of these the first (or thumb), fourth, and fifth consist each of a metacarpal and two osseous phalanges, in the second and third the number of phalanges varies slightly. The first digit or thumb is partly free from the wing and always terminates in a claw. The hind limb is but poorly developed.

Few, if any, animals have so delicate a sense of touch as bats. In Spallanzani's experiments, bats deprived of the power of seeing, hearing, or smelling, flew through a room, carefully avoiding the numerous threads that were stretched across it. This sense of touch, so acute as to feel the slightest movements of the air, is probably chiefly exercised by the wing-membrane, the greatly developed ear-conch, and, in the leaf-nosed bats, by peculiarly formed expansions of integument around the nostrils. In several families of insectivorous bats, a process called the tragus arises inside the inner or anterior margin of the ear (fig. 73), whilst a lobe at the base of the outer margin opposite the tragus, and known as the antitragus, is sometimes of considerable dimensions. The ears are extremely mobile.

Bats vary in their powers of flight almost as greatly as birds do, those with long narrow wings being much swifter than the short-winged forms. The species of stronger flight appear, as a rule, earlier in the evening, even in some cases before sunset, and may often be seen hawking insects in company with swallows and

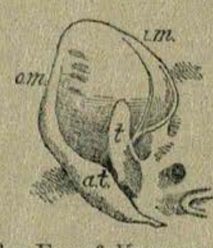

Fig. 73.—Ear of *Vesperugo abramus*.
o.m., outer margin; *i.m.*, inner margin; *t.*, tragus; *a.t.*, antitragus.

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swifts, high in the air. Several kinds of *Vesperugo*, *Miniopterus*, *Megaderma*, and *Nycticejus* may be cited amongst the swifter flying forms. On the other hand, the species of *Rhinolophidæ* and those belonging to the genus *Vespertilio* have a comparatively slow flight and rarely rise far from the ground. They appear as a rule later in the evening, and only in fine weather. Some of the longer-winged bats, especially the species of *Vesperugo*, are easily distinguished on the wing by the quickness with which they change the direction of their flight. More observations of the flight and habits in general of Indian bats are needed.

From the weakness and reversed position of the hind limbs, bats are unable to walk like other mammals, and when, from any cause, they are induced to descend to the ground, they make most awkward attempts to progress on all fours, their thumbs being mainly used in locomotion. By means of the claws on the toes and that on the thumb, they can climb up any uneven sloping or vertical surface. When at rest they suspend themselves by their hind feet to trees, or in caves, old buildings, &c., and remain hanging head downwards. When moving about, they also hang by their thumbs. The young one is carried by the mother until nearly her own size. Usually one is produced at a birth, but at most two. Amongst many bats the sexes live apart except at the pairing-season. As in the *Primates*, the females have only two pectoral teats, but in certain families a pair of nipple-shaped appendages are developed in the inguinal region.

In temperate regions bats hibernate in the winter, a number of them being frequently found huddled together. Some observers have supposed that no hibernation takes place in India; but the insectivorous forms, in Northern India at all events, are but rarely seen abroad during the cold season, though the *Pteropidæ* are as active as at other times.

Bats were by Linnæus classed amongst the Primates, and, until recently, many naturalists assigned to the *Chiroptera* a very high position amongst Mammalia. It has, however, been shown that the true position of bats is next to the *Insectivora*, and that both, with their poorly developed brains, are of inferior grade.

A complete account of the order has been published by Dobson in his 'Catalogue of the Chiroptera in the Collection of the British Museum,' from which work and the same author's 'Monograph of the Asiatic Chiroptera' the following descriptions of the Indian members of the order are chiefly taken.

The bats are by Dobson and others classed in two principal divisions called suborders, but not distinguished by characters of similar importance to those which serve to separate the *Pinnipedia* from *Fissipedia* in *Carnivora*, and the *Dermoptera* from the true *Insectivora*. The first of these suborders includes a single family of frugivorous bats; to the other belong the five families of insectivorous Chiroptera. All are thus discriminated:—

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A. Crowns of the molar teeth with a longitudinal furrow, not tubercular; second or index finger with three phalanges besides the metacarpal bone, and generally terminating in a claw (in all Indian genera except *Eonycteris*); the two margins of each ear-conch meeting at the base. Frugivorous	I. MEGACHIROPTERA. **Pteropodidæ.**
B. Crowns of the molar teeth acutely tubercular, with transverse furrows; second or index finger with a single rudimentary phalanx (in *Rhinopoma* only with two phalanges) and clawless: the two margins of each ear-conch arising from the head separately. Carnivorous, and, for the most part, insectivorous	II. MICROCHIROPTERA.
a. Tail contained within the interfemoral membrane, or very little produced beyond its hinder margin. First phalanx of middle finger extended, in repose, in a line with the metacarpal bone.	
a′. Tragus none, a complicated nose-leaf	**Rhinolophidæ.**
b′. Tragus present, a nose-leaf	**Nycteridæ.**
c′. Tragus present, no nose-leaf	**Vespertilionidæ.**
b. Tail perforating the interfemoral membrane and appearing on its upper surface, or produced considerably beyond the truncated membrane; first phalanx of middle finger folded, in repose, on the dorsal surface of the metacarpal bone.	
a′. Two osseous phalanges (besides metacarpal bone) in middle finger. Tragus distinct, no nose-leaf	**Emballonuridæ.**
b′. Three phalanges in middle finger.	**Phyllostomatidæ** (American).

All of the families except the *Phyllostomatidæ* are represented in India.

The measurements of bats are in almost every case taken from specimens preserved in alcohol. Like all other mammals, bats vary considerably in their dimensions, the figures quoted being, when several measurements are available, those of an average specimen.

Bats are known generally as *Chamgidar* in Hindi; *Shab-par* or *Shab-parak* in Dakhani; *Chamgúddri*, Bengali; *Chidgu* at Bhagulpur; *Chútú bardwi* in Ho Kol; *Gabbelai* or *Jiburai*, Telegu; *Kanka-pati*, Canarese; *Vulhá*, Cingalese; *Phiyu longtá*, Bhotia; *Brin*, Lepcha; *Soshiro*, *Phakarang*, and *Sepcha*, Naga. These names are used for all species of Microchiroptera.

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Suborder *MEGACHIROPTERA.*

Family PTEROPODIDÆ.

This family consists of the fruit-eating bats, the largest of which are commonly known in India as flying-foxes. Some smaller forms, of less conspicuous coloration, are also comprised. All are distinguished from other bats by the characters of the molar teeth, with longitudinally grooved crowns, by the bony palate being continued, narrowing slowly backwards, behind the last molars, and especially by the form of the ear, the margins of which meet before they reach the head, so that the whole margin forms a more or less regular oval ring, whilst in all insectivorous bats the margins arise independently from the head. As a rule, too, the index finger terminates in a claw, *Eonycteris spelæa* being the only exception to the rule found in the territory of British India.

The following genera occur within the Indian area:—

A. Tongue moderate; inner margin of nostril projecting; a claw to index finger.	
a. No tail, hind neck and shoulders generally much paler than back	PTEROPUS.
b. A tail generally present; upper parts of one colour throughout.	
a′. 5 teeth in upper molar series, 6 in lower	XANTHARPYIA.
b′. 4 teeth in upper molar series, 5 in lower	CYNOPTERUS.
B. Tongue very long; no projecting margin to nostril.	
a. A claw to index; wing from base of 4th toe; tail rudimentary	CARPONYCTERIS.
b. No claw to index; wing from base of 1st toe; tail distinct	EONYCTERIS.

All the *Pteropodidæ* are limited to the tropical and subtropical regions of the Eastern hemisphere with Australia, none being found in America.

Genus **PTEROPUS**, Brisson (1756).

Size large, exceeding all other bats. Muzzle long; nostrils projecting by their inner margins, between which is a deep furrow leading to a vertical groove that divides the upper lip, and has on each side a naked swollen border. Second * or index finger with a distinct claw; metacarpal bone of third or middle finger shorter than second finger. Wing-membrane from the sides of the hairy back, and the back of the second toe. Tail none. Hair of the hind neck and shoulders different in quality from that of the back, and generally much brighter in colour.

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* The thumb, which is free, being classed as the first finger.

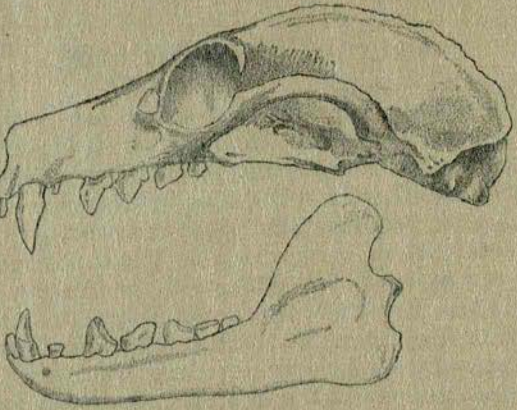

Fig. 74.—Skull of *Pteropus medius.*

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$. Upper incisors in a semicircular row, separated on each side from the canines; lower outer incisors close to the canines, the inner pair generally separated by a slight interval and smaller; first upper premolars generally very small and deciduous.

This genus contains the large fruit-bats commonly known in India as flying-foxes.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Forearm (radius) in adults less than 7 inches long.	
a. Ears pointed, longer than distance from eye to muzzle	*P. medius*, p. 257.
b. Ears rounded, shorter than distance from eye to muzzle	*P. nicobaricus*, p. 260.
B. Forearm in adults more than 8 inches long; ears pointed	*P. edulis*, p. 259.

Beyond India the genus *Pteropus* has a remarkable geographical distribution. The majority of the species inhabit the Malay Archipelago, on both sides of Wallace's line; the range of the genus extending eastward to Samoa, south throughout a considerable part of Australia (not to New Zealand or Tasmania), and eastward to Madagascar and the Comoro Islands, but not to Africa.

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134. **Pteropus medius.** *The Indian Fruit-Bat or Flying-Fox.*

Pteropus medius, *Temm. Mon. Mam.* i, p. 176 (1827); *Dobson, J. A. S. B.* xlii, pt. 2, p. 196, pl. xiv, fig. 1 (ear); *id. Mon. As. Chir.* p. 18; *id. Cat. Chir. B. M.* p. 51; *Blyth, Mam. Birds Burma,* p. 14; *Anderson, Cat.* p. 101; *Scully, J. A. S. B.* lvi, pt. 2, p. 236.
Pteropus edwardsi, *Horsfield, Cat.* p. 28; *Kelaart, Prod.* p. 27; *Adams, P. Z. S.* 1858, p. 512; *Blyth, Cat.* p. 20; *Jerdon, Mam.* p. 18; *Hutton, P. Z. S.* 1872, p. 691; *nec Geoffr.*
Pteropus leucocephalus, *Hodgson, J. A. S. B.* iv, p. 700 (1835).
Pteropus assamensis, *McClelland, P. Z. S.* 1839, p. 148.
Pteropus kelaartii, *Gray, Cat. Monkeys, Lemurs, and Fruit-eating Bats B. M.* p. 104 (1870).

Gadal, Barbagal, Bádúr, Pata debli, H.; *Bádúl,* Beng.; *Warbagúl,* Mahr.; *Toggal báwuli,* Can.; *Sikat yelle,* Wadari; *Sikurayi,* Tel.; *Barvalu,* Mal.; *Loco-vaola, Wawal,* Cing.; *Leng-tshwai, Leng-nek,* Burmese.

Ears naked and acutely pointed, their length exceeding the distance from the eye to the end of the nose; the outer margin concave near the tip. Nose naked above. Fur of hind-head, neck all round, shoulders, and breast woolly, coarser and longer than that of the back. There is a narrow hairy band above the wing-membrane behind the humerus and part of the forearm, and the interfemoral membrane is covered with hair above except near the edge. In males there is generally a circular tuft of rigid greasy hairs, bright reddish in colour, on each side of the neck.

Colour. This is variable, *as in all bats.* The head is generally reddish brown, the muzzle often darker and sometimes black; the hind neck and shoulders paler, generally pale brownish yellow to straw-colour; back behind the shoulders dark brown or black, occasionally with a few white hairs interspersed. Lower parts yellowish brown, chin and fore neck usually darker, as are the region about the vent and the flanks; sometimes the whole lower breast and abdomen are dark brown or black.

Dimensions. Head and body about 9 inches (varying from 7·5 to 10·5), length of ear from orifice 1·45, forearm 6·6; basal length of skull 2·7, extreme length 2·9, zygomatic breadth 1·7. The expanse of the wings is about 4 feet. Weight 20 to 22 oz.

Distribution. Throughout India, Ceylon, and Burma. Not found in the Himalayas except near the base, or as a visitor from the plains. Rare in Western Rajputana, Cutch, and Sind, and not known to occur in the Punjab. Not recorded east or south of Burma.

Habits. Jerdon's account is good. He says:—"During the day they roost on trees*, generally in large colonies. Many hundreds often occupy a single tree, to which they invariably resort if not driven way. Towards sunset they begin to get restless, move

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* Tickell notices their preference for tamarind trees, and I think he is right. In Bengal they sometimes remain on bamboos. They hang head downwards, wrapped in their wings, and precisely resemble large dead leaves.

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about along the branches, and by ones and twos fly off for their nightly rounds. If water is at hand—a tank, a river, or the sea—they fly cautiously down and touch the water, but I could not ascertain if they took a sip, or merely dipped part of their bodies in. They fly vast distances occasionally to such trees as happen to be in fruit. They are fond of most garden fruit (except oranges, &c.), also the neem, jamoon, ber, and various figs *. About the early dawn they return from their hunting-grounds, and the scene that then takes place is well described by Tickell in an excellent memoir published in the 'Calcutta Journal of Natural History' †, from which I extract the following: 'From the arrival of the first comer until the sun is high above the horizon, a scene of incessant wrangling and contention is enacted amongst them, as each endeavours to secure a higher and better place, or to eject a neighbour from too close vicinage. In these struggles the bats hook themselves along the branches, scrambling about "hand over hand" with some speed, biting each other severely, striking out with the long claw of the thumb, and shrieking and cackling without intermission. Each new arrival is compelled to fly several times round the tree, being threatened from all points, and when he eventually hooks on has to go through a series of combats, and be probably ejected two or three times before he makes good his tenure. The "alarums-excursions" continue till 8, 9, or 10 A.M., when the bats get sleepy, and hang side by side in peace, fanning themselves with their wings, which in repose they wrap round the head.'"

According to Dr. Shortt, P. Z. S. 1863, p. 438, these bats capture small fish, but Jerdon suspects, and probably with reason, that the habit of skimming water in the evening has been mistaken for fishing. I have often observed this habit: the head is lowered, the animal pauses in its flight, and the water is just touched, I believe, by the tongue or lower jaw. I have no doubt that some water is drunk, and this is the opinion of both Tickell and McMaster. The former says that flying-foxes in confinement drink at all hours, lapping with their tongues. The latter has noticed many other bats drink in the evening as well as the flying-foxes.

The process of eating is also described by Tickell. The bats hang, head downwards as usual, by one foot, and hold the fruit with the other, not by grasping, but by striking the claws in like a fork. The jaws are moved slowly up and down, and the food

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* They are also fond of the fruit of *Terminalia catappa*, and are said by Day to extract the kernels, often utilizing the verandahs of houses as a resort whilst thus engaged, and alarming the inhabitants by sounds suggestive of house-breaking. The same writer states that these bats often drink toddy (palm-juice) from the pots attached to the trees from which it is collected, and are consequently found intoxicated and helpless beneath the trees in the morning ('Land of the Permauls,' p. 439).

† Vol. iii. p. 29.

bitten off in large mouthfuls, both cheeks being crammed full and the tongue protruded.

The numbers in a colony are at times very great, and the trees on which the bats perch are frequently injured and sometimes killed. *Pteropi* fly singly, never in a flock, with a steady but not very rapid flight. Anderson counted, in Calcutta, 70 passing per minute, for about half an hour, over a breadth of about 250 yards, but others could be seen on all sides as far as the eye could detect them. This was in the twilight immediately after sunset. McMaster, at Rangoon, counted, with the help of a friend, 600 passing in five minutes.

Jerdon relates an instance, in the Ghazipur district, of several individuals being killed by a hot dry wind, and McMaster states the same has been observed at Madras.

P. medius has a peculiar offensive musky smell, by which its presence in the neighbourhood may often be detected. This smell Dobson attributes to the secretion from the glands marked by coarse hair on each side of the neck. But these glands are said to be peculiar to the male, whilst, according to Tickell, the female has an equally evil odour.

The power of flight in this species is sufficient to enable it to visit fruit-trees many miles distant from its resting-place. Sterndale records having captured one alive, though tired, at sea, 200 miles from the nearest land.

The common Indian flying-fox is easily tamed. The flesh is eaten by many classes of natives of India, and is said by some Europeans, who have tried it, to be well flavoured and delicate.

The female has but one young (as have most other bats) at a birth, usually born, according to Tickell, about the end of March or in April, and carried about by the mother until the end of May or the beginning of June, by which time the young animal is nearly as large as its parent.

135. **Pteropus edulis.** *The Malay Flying-Fox.*

Pteropus edulis, *Geoffroy, Ann. Mus.* xv, p. 90 (1810); *Cantor, J. A. S. B.* xv, p. 186; *Blyth, Cat.* p. 20; *Dobson, J. A. S. B.* xlii, pt. 2, p. 199, pl. xiv, fig. 3 (ear); *id. Mon. As. Chir.* p. 20; *id. Cat. Chir. B. M.* p. 49; *Anderson, Cat.* p. 100.

Kĺúang, Malay.

The largest bat known, the size being larger than that of *P. medius*. Ears naked, acutely pointed, longer than the distance from the eye to the end of the nose, narrower than those of *P. medius* (the breadth being only half the length), upper outer margin but slightly concave. The wing-membrane arises farther from the middle of the back, and the hairy back is much broader, otherwise the distribution of the fur is similar.

Colour generally similar to that of *P. medius*, but rather darker. Head and breast rufous-brown, varying in tint; hind neck and back between the shoulders paler yellowish or rufous-brown, or sometimes bright rufous; back dark brown or black with a mixture of grey hairs; lower parts either rufous-brown throughout, or the lower breast and abdomen nearly black with an intermixture of grey. Some specimens are black throughout.

Dimensions. Head and body 12 inches, ear from orifice 1·75, forearm 8·8; basal length of skull 3, zygomatic breadth 1·75. The expanse of the wings is fully 5 feet.

Distribution. The Indo-Malayan subregion (Malayan Peninsula, Sumatra, Java, Borneo, Philippines, &c.), extending, it is said, to the Nicobar and Andaman Islands, and perhaps into Southern Tenasserim, a specimen from Mergui, in bad condition however, having been referred to this species by Blyth. This species was obtained by Anderson in the Mergui Archipelago.

The habits are similar to those of *P. medius.*

136. **Pteropus nicobaricus.** *The Nicobar Flying-Fox.*

Pteropus nicobaricus, *Fitzinger, Sitzb. Wien. Ak.* xlii, 1861, p. 389 (no description); *Zelebor, Novara, Reise, Säugeth.* p. 11 (1868); *Dobson, J. A. S. B.* xlii, pt. 2, p. 198, pl. xiv, f. 2 (ear); *id. Mon. As. Chir.* p. 17; *id. Cat. Chir. B. M.* p. 54; *Anderson, Cat.* p. 102.

Pteropus melanotus, *Blyth, Cat.* p. 20 (1863) (no description).

Size of *P. medius.* Ears naked, short, rounded at the tip, their breadth when laid flat about three-quarters of the length, which is less than the distance from the eye to the end of the nose. Wing from the back and distribution of fur as in *P. medius.* Skull rather shorter and broader.

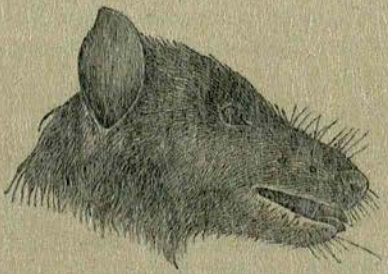

Fig. 75.—Head of *Pteropus nicobaricus.* (Dobson, Mon. As. Chir.)

Colour. In males the coloration is sometimes as in *P. medius,* but generally darker; head dark brown above and below; hind neck and between shoulders rufous to yellowish brown; back dark brown: lower parts brown, paler in the middle of the abdomen. Young males and females often intensely black throughout, or with only an indication of the pale collar.

Dimensions. Head and body 9 inches long (varying from 8 to 10·5), ear 1·05, forearm 6·5; total length of skull 3, basal length 2·7, zygomatic breadth 1·4 (*Zelebor*).

Distribution. Andaman and Nicobar Islands; a variety (*P. condorensis*, Peters) from Pulo Condore; Java is also given by Dobson. A skull is recorded in Anderson's 'Catalogue' from Mergui, but the locality is very doubtful, as the history of the specimen is unknown.

Genus **XANTHARPYIA**, Gray (1843).

Syn. *Eleutherura*, Gray (1844); *Cynonycteris*, Peters (1852).

Size moderate, muzzle long; nostrils projecting by their inner margins, between which is a wide furrow, leading to a broad groove across the upper lip; the margins of this groove are naked, but less swollen than in *Pteropus*. Second or index finger with a distinct claw; metacarpal bone of the middle finger as long as the index finger or longer. Wings from the sides of the hairy back and from the base of the second toe. Tail short but distinct, partially included in the narrow interfemoral membrane. Fur of the back and shoulders of the same colour and quality throughout.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$.

This genus and the next three are distinguished from *Pteropus* by smaller size and duller coloration.

Only a single species is known within Indian limits. The genus ranges throughout Southern Asia, extending eastward into the Malay Archipelago and westward into Africa.

137. **Xantharpyia amplexicaudata.** *The fulvous Fruit-Bat.*

Pteropus amplexicaudatus, *Geoff. Ann. Mus.* xv, p. 96 (1810).
Pteropus leschenaultii, *Desm. Mam.* p. 110 (1822); *Kelaart, Prod.* p. 27; *Blyth, Cat.* p. 21; *Jerdon, Mam.* p. 19.
Pteropus pyrivorus, *Hodgs. J. A. S. B.* iv, p. 700 (1835).
Cynonycteris amplexicaudata, *Peters, MB. Akad. Berl.* 1867 p. 865; *Dobson, P. A. S. B.* 1872, p. 154; *id. J. A. S. B.* xlii, pt. 2, p. 202, pl. xiv, fig. 8 (ear); *id. P. A. S. B.* 1873, p. 110; *id. Mon. As. Chir.* p. 29; *id. Cat. Chir. B. M.* p. 72; *Anderson, Cat.* p. 103; *Scully, J. A. S. B.* lvi, pt. 2, p. 237.

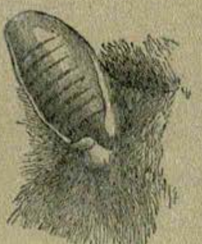

Fig. 76.—Ear of *X. amplexicaudata.* (Dobson, Mon. As. Chir.)

Ears almost naked, oval, rounded at the tip; outer margin with a distinct though small convex lobe at the base. Fur short. First upper premolar minute, equally distant from the canine and the second premolar.

Colour of fur brown, varying in tint, the lower parts duller than the upper.

Dimensions. Length of head and body 5 inches, tail 0·7, forearm 3·35, ear from orifice 0·75; total length of skull 1·5, zygomatic breadth 0·9.

Distribution. Throughout the greater part of India, Ceylon, and Burma. This species is recorded from the Himalayas (base only), Sind, Singhbhoom, Madras, Trichinopoly, Ceylon, Pegu, and Moulmein, but it is not commonly met with and appears to be of local distribution. It extends on the west to the Persian Gulf, where I obtained specimens, on the east and south-east throughout the Malay Archipelago to the Philippines and Timor.

Habits. This is, in many cases at all events, a cave-haunting bat. I shot several in the large salt-caves of Kishm Island, Persian Gulf, where it abounded, and Mr. Murray found it in old tombs and in caves near Karachi. An allied species, *X. ægyptiaca*, inhabits the chambers of the Pyramids and has been found in a cave in Palestine.

Like the other fruit-bats, this animal is very voracious and possesses great powers of flight. According to Hodgson, it has been known to travel 30 or 40 miles and to return in a single night. Scully has shown that bats of this species, visiting the Nepal Valley, probably come from the Nowakot district, only 16 miles distant, not from the plains, as Hodgson supposed. Dobson was informed that near Moulmein a colony of *X. amplexicaudata* was found to feed on mollusca left exposed by the tide.

Genus **CYNOPTERUS**, F. Cuv. (1825).

Syn. *Pachysoma*, Geoffr. (1828).

Muzzle much shorter and blunter than in *Pteropus* or *Xantharpyia*; nostrils projecting by their inner margins, between which is a broad furrow. A shallow vertical groove crosses the middle of the upper lip and has broad naked margins. Index finger with a distinct claw; metacarpal bone of the middle finger as long as the index finger or longer; wings from the sides of the hairy back and from the base of the first toe.

Dentition in all Indian forms: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{1-1}{2-2}$.

This genus is found throughout the Oriental region.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Tail present.	
a. Base of outer margin of ear-conch straight or faintly convex.	
a'. Ears nearly double the length of the muzzle and margined with white	*C. marginatus*, p. 263.
b'. Ears not much longer than muzzle and with white borders	*C. brachyotus*, p. 264.
c'. Ears not much longer than muzzle, without white border	*C. scherzeri*, p. 264.
b. Base of outer margin of ear-conch forming a distinct rounded projection.........	*C. brachysoma*, p. 264.
B. No tail	*C. blanfordi*, p. 265.

CSL

138. Cynopterus marginatus. *The short-nosed Fruit-Bat.*

Pteropus marginatus, *Geoff. Ann. Mus.* xv, p. 57 (1810).
Cynopterus marginatus, *Blyth, J. A. S. B.* xiii, p. 479; *id. Cat.* p. 22; *id. Mam. Birds Burma*, p. 15; *Elliot, Mad. Jour. L. S.* x, p. 96; *Cantor, J. A. S. B.* xv, p. 187; *Kelaart, Prod.* p. 28; *Jerdon, Mam.* p. 20; *Hutton, P. Z. S.* 1872, p. 693; *Dobson, J. A. S. B.* xlii, pt. 2, p. 200, pl. xiv, f. 4 (ear); *id. Mon. Asiat. Chir.* p. 24; *id. Cat. Chir. B. M.* p. 81; *Anderson, Cat.* p. 104; *Scully, J. A. S. B.* lvi, pt. 2, p. 239.

Cham-gadili, Beng.; *Chota badur*, H.; *Lenzwe, Lenwet*, Burm.

Ears nearly naked, rounded at the tip, about twice the distance from eye to nostril in length, without any prominent basal lobe to the outer margin. First upper premolar minute, in the middle of the space between the canine and the second premolar, and slightly on the outer side of the tooth-row.

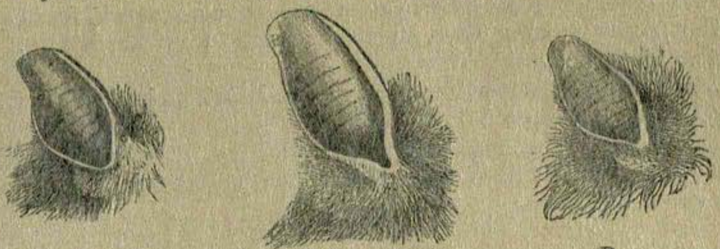

Fig. 77.—Ears of: A, *Cynopterus marginatus*; B, *C. brachyotus*; C, *C. scherzeri*. (Dobson, Mon. As. Chir.)

Colour brown, very variable in tint, generally snuff-brown or umber-brown, but some individuals are ferruginous or yellowish brown, others dull grey-brown. Males, especially in the breeding-season, have a collar of stiff reddish-yellow or rusty-brown hairs. Outer and inner margins of ear-conch and sometimes the whole margin to the tip white.

Dimensions. Head and body 4·4 inches, tail 0·4, ear from orifice 1, forearm 3; skull, total length 1·45, zygomatic breadth 0·95.

Distribution. Common throughout India from the base of the Himalayas to Lake Comorin; also Ceylon, Burma, the Malay Peninsula and Archipelago to the Philippines. Not known to occur west of Sind, where, however, it is by no means rare.

Habits. This bat is found on trees in the daytime. I have observed it solitary in forest, but Jerdon states that it roosts in companies on the folded leaves of plantains, Palmyra palms, and other trees. Tickell records having occasionally met with it in caverns and in hollow trees. It lives entirely on fruit and is extremely destructive to plantains, guavas, and mangoes. Its voracity is mentioned by almost every observer. One instance will suffice. Dobson gave to an individual in Calcutta a plantain weighing, with the skin removed, two ounces. The whole fruit was consumed in three hours, whilst the bat, when killed ne morning, weighed only one ounce.

Blyth notes that the flight of this species is particularly light and buoyant, very different from the direct heavy flight of *Pteropus*, but the general manners and voice of the two are very similar.

139. **Cynopterus brachyotus.** *The Andaman short-nosed Fruit-Bat.*

Cynopterus brachyotis, *S. Müller, Tijdsch. Natuur. Gesch.* v, p. 146 (1839).

Cynopterus marginatus, var. andamanensis, *Dobson, J. A. S. B.* xlii, pt. 2, p. 201, pl. xiv, fig. 5 (ear).

Cynopterus brachyotus, *Dobson, Mon. As. Chir.* p. 26; *Scully, J. A. S. B.* lvi, pt. 2, p. 239.

This resembles the previous species in all respects except in having much smaller ears, which measure from the orifice 0·7 instead of 1 inch.

Dimensions of a female: head and body 3·7 inches, tail 0·4, ear as above 0·7, forearm 2·6.

Distribution. Andaman Islands and Borneo. Scully states that two specimens, obtained by him in Nepal, agree with this form in the size of the ears.

140. **Cynopterus scherzeri.** *The Nicobar short-nosed Fruit-Bat.*

Pachysoma scherzeri, *Fitzinger, Sitzungsb. Wien. Akad.* xlii, p. 390 (1861) (no description); *Zelebor, Novara, Reise, Säugeth.* p. 13 (1868).

Cynopterus scherzeri, *Dobson, J. A. S. B.* xlii, pt. 2, p. 201, pl. xiv, fig. 6 (ear); *id. Mon. As. Chir.* p. 26; *id. Cat. Chir. B. M.* p. 84; *Anderson, Cat.* p. 106.

Ears naked, rounded at the tip, without any distinct basal lobe to the outer margin, and but slightly exceeding in length the distance from the eye to the nostril. Muzzle broader than in *C. marginatus*, and frontal region narrower.

Colour dark brown. According to Dobson the ears have no white edges, but I think there are traces of white on the inner margins of the ears in a British Museum specimen.

Dimensions. Head and body of a female 3·7 inches long, tail 0·55, ear from orifice 0·6, forearm 2·7.

Distribution. The types were from Car-Nicobar Island, where the species was found on the leaves of cocoa-nut palms by the 'Novara' Expedition and subsequently by Dr. Stoliczka and others. Another specimen, apparently of this form, from Timor, is in the British Museum.

141. **Cynopterus brachysoma.** *The thick-bodied Fruit-Bat.*

Cynopterus brachysoma, *Dobson, J. A. S. B.* xl, pt. 2, p. 260 (1871), xlii, pt. 2, p. 202, pl. xiv, fig. 7 (ear); *id. Mon. As. Chir.* p. 27; *id. Cat. Chir. B. M.* p. 85; *Anderson, Cat.* p. 106.

Ears rounded at the tip, and furnished with a prominent rounded lobe at the base of the outer margin; their length from the orifice slightly exceeds that of the muzzle from the eye to the nostril. Body very short and thick. Tail very short and slender and completely concealed by the fur, which is long and dense.

Colour slaty blue with a greyish or silvery tinge, tips of the hairs sooty brown.

Dimensions of an adult female: head and body 2·9 inches, tail 0·25, ear from orifice 0·6, forearm 2·2.

Distribution. South Andaman Island, whence a single specimen, the only one hitherto recorded, was obtained by Dr. Stoliczka.

142. **Cynopterus blanfordi.** *The tailless short-nosed Fruit-Bat.*

Cynopterus blanfordi, *Thomas, Ann. Mus. Civ. Genova,* ser. 2 *a,* x (1891).

No tail. Only a trace of an interfemoral membrane. Ears naked, rounded at the tip, a distinct lobe at the base of the outer margin. Fur long on the body and legs and especially between the legs.

Colour dark brown with a greyish tinge, inner margin of the ear whitish.

Dimensions of an adult female in spirit: head and body 2·5 inches, ear from orifice 0·6, forearm 2.

Distribution. Karennee, where specimens were obtained by Mr. Fea.

Genus **CARPONYCTERIS,** Lydekker (1891).

Syn. *Macroglossus,* F. Cuv. (1825); nec *Macroglossa,* Ochs. (1816).

Muzzle cylindrical, very long and narrow; nostrils with the margins not projecting, though a shallow groove divides them. In some cases this is continued as a fine vertical impressed line across the upper lip, but generally the upper lip is not grooved; it is naked and convex in the middle. Tongue very long and attenuated, covered with numerous long brush-like papillæ. Index finger with a claw, metacarpal bone of middle finger equal to the index finger or longer than it. Wings from the sides of the hairy back and from the base of the fourth toe; tail very short, quite rudimentary or wanting.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$. The incisors small and rather wide apart from each other, the molars very small and weak with low crowns, the first upper premolar scarcely inferior in size to the second.

But a single species is known.

143. **Carponycteris minima.** *The small long-tongued Fruit-Bat.*

Pteropus minimus, *Geoff. Ann. Mus.* xv, p. 97 (1810).
Macroglossus minimus, *Blyth, J. A. S. B.* xxviii, p. 293; *id. Cat.* p. 21; *id. Mam. Birds Burma,* p. 15; *Dobson, J. A. S. B.* xlii, pt. 2, p. 205, pl. xiv, fig. 11 (ear); *id. Mon. As. Chir.* p. 34; *id. Cat. Chir. B. M.* p. 96; *Anderson, Cat.* p. 107.

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Ears rather longer than from the eye to the nostril, naked, rounded at the end, the outer margin with a small pointed basal lobe. Nostrils not prominent. Lower jaw projecting slightly beyond the upper. Eyes large. Interorbital membrane very narrow. Fur long.

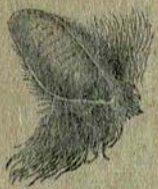
Fig. 78.—Ear of *C. minima.* (Dobson, Mon. As. Chir.)

Colour light brown, more or less rufous above, rather paler and greyer below.

Dimensions of an adult female: head and body 2·3 inches, ear 0·6, forearm 1·35. A skull measures 1·05 in total length and 0·6 in zygomatic breadth. This is the smallest of all known fruit-bats.

Distribution. Common in the warm valleys of Sikhim and extending thence through Burma to the Malay Archipelago and North and West Australia.

Habits. This small fruit-bat remains suspended to branches of trees during the day, and is occasionally found in old houses and sheds. It lives on fruit of every description.

Genus **EONYCTERIS**, Dobson (1873).

Muzzle long; nostrils not projecting, a shallow furrow between them, and a narrow vertical groove across the middle of the upper lip, which is naked throughout the area below the nostrils and the space between them. Index finger without a claw; metacarpal bone of the middle finger as long as the index finger. Wing from the side of the hairy back and from the base of the first toe. Tail short, distinct, the base contained in the narrow interfemoral membrane. Tongue very long and armed with long recurved papillæ.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$. First upper premolar minute. Incisors small, subdistant, and molars small, scarcely elevated above the gum, as in *Carponycteris.*

A single species is known.

144. **Eonycteris spelæa.** *Dobson's long-tongued Fruit-Bat.*

Macroglossus spelæus, *Dobson, J. A. S. B.* xl, pt. 2, p. 261, pl. x, figs. 3, 4 (1871), xli, p. 334.

Eonycteris spelæa, *Dobson, J. A. S. B.* xlii, pt. 2, p. 204, pl. xiv, fig. 10 (ear); *id. Mon. As. Chir.* p. 33; *id. Cat. Chir. B. M.* p. 94; *Blyth, Mam. Birds Burma,* p. 15; *Anderson, Cat.* p. 106.

Ears moderately large, the tips but little rounded, a small projecting basal lobe to the outer margin. Thumb short, the base of the terminal phalanx included in the membrane. Fur short and thin. On each side of the anal orifice and a little behind it is a small subcutaneous glandular body. The tongue can be drawn nearly half an inch from the mouth in spirit specimens; the papillæ near the tip are very long.

Colour dark brown throughout, the lower portions sometimes a little paler.

leaves of

state of constant agitation.

Dimensions of an adult male: head and body 4·5 inches, tail 0·55, ear from orifice 0·75, forearm 2·85; total length of skull 1·45, zygomatic breadth 0·8.

Distribution. The types came from the Farm Caves, Moulmein. Specimens have also been recorded from Cambodia and Java (Dobson, P. Z. S. 1878, p. 877).

Habits. This appears to be a cavern inhabitant like *Xantharpyia amplexicaudata.* Nothing more is known of its habits, and the uses to which the peculiar extensile tongue of this genus and of *Carponycteris* is applied are unknown.

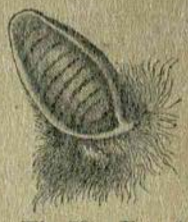

Fig. 79.—Ear of *E. spelæa.* (Dobson, Mon. As. Chir.)

Suborder *MICROCHIROPTERA.*

Family RHINOLOPHIDÆ.

A well-developed nose-leaf, consisting of foliaceous skin-p around the nostrils, which are situated in a depression on the surface of the muzzle. Ears large, generally separated; no tragus. Two phalanges in addition to the metacarpal bone in the middle finger, index finger consisting only of the metacarpal. Premaxillary bones rudimentary and suspended from the nasal cartilages.

The upper incisors, two in number, are quite rudimentary; the first upper premolar minute; the molars well developed, with acute **W**-shaped cusps. The lower incisors are tricuspid. The milk-teeth are absorbed before birth.

The skull is large, the nasal bones much expanded. The females have two nipple-shaped prominences in front of the pubis *. Tail distinct, produced to the posterior margin of the interfemoral membrane.

The very complicated nasal appendages consist of three parts, generally to be traced (fig. 80, p. 268). (1) The flat anterior nose-leaf, generally horseshoe-shaped, which more or less covers the sides and anterior extremity of the muzzle, and includes the nasal apertures, between or behind which (2) a median process or ridge, the central nose-leaf or *sella*, is placed; whilst more posteriorly on the face (3) the terminal or posterior nose-leaf arises vertically from the forehead, or extends backwards between the ears. The surface of the posterior nose-leaf is generally divided into cells by ridges, transversely arranged in *Rhinolophus*, longitudinally in *Hipposiderus.*

These are the most highly organized of insectivorous bats.

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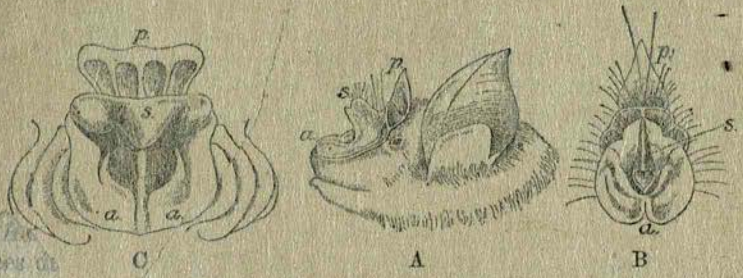
* These probably represent the inguinal teats of other Mammals. Cantor, J. A. S. B. xv, p. 182, records that a female *Hipposiderus*, during lactation, [illegible] of these inguinal warts much larger than the other. The young [illegible] ...nces.

The greatly developed nose-leaf is evidently an organ of special perception akin to touch *; the variations in the form of this appendage are characteristic of the different species. The *Rhinolophidæ* are more nocturnal and less crepuscular than other insectivorous *Chiroptera* a circumstance perhaps connected with the development of the nose-leaf.



—A. Head of *Rhinolophus affinis*, nat. size. B. Nose-leaf of *R. hippo- rus*, × ⅔. C. Nose-leaf of *Hipposiderus armiger*, ×2. *a.* Anterior ; *p.* posterior nose-leaf ; *s*, sella.

mily is found throughout the temperate and tropical parts Eastern hemisphere and Australia, but not in Polynesia east of New Guinea, nor in America. It is divided into two subfamilies :—

First toe with two, remaining toes with three joints each ; a distinct antitragus separated by a notch from the outer margin of the ear . *Rhinolophinæ.*
All the toes with two joints ; no notch separating the antitragus from the outer margin of the ear. *Hipposiderinæ.*

It may be useful to repeat here that the measurements of bats, mostly taken, with other details, from Dobson's work, are from alcoholic specimens.

Subfamily RHINOLOPHINÆ.

Genus **RHINOLOPHUS**, Desm. (1803).

The only genus in the subfamily. The nose-leaf is large and perfect, all three parts (anterior, median, and posterior) being well developed ; the anterior is horseshoe-shaped, usually with a deep incision in the middle in front, and rests flatly on the muzzle, the nostrils opening one inside each arm of the horseshoe ; between and behind the nostrils the median nose-leaf or sella commences, the anterior portion being flat or recumbent on the nose, the continuation is then bent up and becomes an erect process, rising vertically from the face and consisting in most cases of two lamellæ at right angles to each other, the anterior transverse, the posterior longitudinal ; the latter usually forms a connecting-process and joins the sella to the anterior portion of the posterior nose-leaf, which, in this genus, is always more or less triangular and terminates behind in a single point, whilst its surface in most species is divided into cells or hollows by transverse laminæ, often divided in the middle.

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* Hutton observed that when the animals were disturbed the nose-l several *Rhinolophidæ* were kept in a state of constan

This genus may be distinguished by the form of the posterior nose-leaf and also by the deep notch at the base of the outer ear-margin, dividing off the large antitragus.

The wings are very large, the metacarpal bone of the fourth finger exceeds that of the second (or index) in length. Basioccipital at base of skull very narrow between the auditory bullæ.

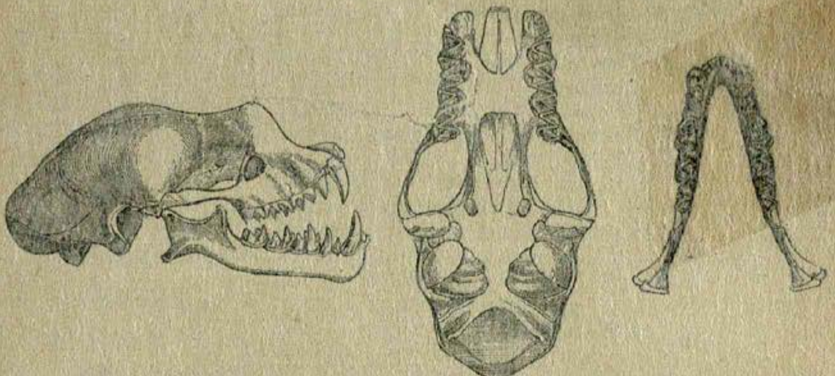

Fig. 81.—Skull of *Rhinolophus ferrum-equinum*, ×2. (Blasius, Säugeth. Deutschl.)

Dentition: i. $\frac{2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{3-3}$, m. $\frac{3-3}{3-3}$. The first upper premolar minute, pointed, either in the tooth-row or else external to it between the closely approximated canine and second premolar, which is large. Second lower premolar generally minute and external to the tooth-row.

The genus *Rhinolophus* inhabits the temperate and tropical regions of the Eastern hemisphere, including Australia. No less than 13 species out of about 25 known at present are found within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Size large; forearm exceeding 2·5 inches .... *R. luctus*, p. 270.
B. Size moderate; forearm 1·75 to 2·5 inches
  a. Posterior nose-leaf thickened around a large internal subcruciform hollow; forearm 1·85 .... *R. cœlophyllus*, p. 272.
  b. Posterior leaf without large internal hollow.
    a′. Second upper premolar close to canine, first premolar minute, external.
      a″. Lower lip with a single median vertical groove; forearm 2·25 .... *R. ferrum-equinum*, [p. 278.
      b″. Lower lip with 3 grooves; forearm 2·25 .... *R. tragatus*, p. 279.

CSL

- *b'*. Second upper premolar separated from canine by a space in which the small first premolar is placed.
  - *a''*. Erect transverse process of sella with wing-like lateral expansions above nostrils; forearm 2 . . . . *R. trifoliatus*, p. 272.
  - *b''*. No lateral expansions to erect process of sella.
    - a^3. Anterior recumbent process of sella expanded, cup-shaped; erect transverse process much higher than posterior longitudinal buttress; forearm 2·25 . . . . *R. nitratus*, p. 273.
    - b^3. Anterior recumbent process of sella not expanded.
      - a^4. Transverse and longitudinal erect processes of sella equal in height; forearm 2·2 . . . . *R. pearsoni*, p. 273.
      - b^4. Longitudinal (posterior) process the higher.
        - *α*. Recumbent process of sella broader than erect transverse process.
          - *α'*. Margins of posterior nose-leaf concave; forearm 2·1 . . . . . . *R. affinis*, p. 274.
          - *β'*. Margins of posterior leaf straight; forearm 2·05 . . . . . . *R. andamanensis*, [p. 275.
        - *β*. Recumbent process and erect transverse processes the same width; forearm 2. . . . . *R. petersi*, p. 275.

- C. Size small; forearm less than 1·75 inches.
  - *a*. Ears very large, longer than the head; forearm 1·6 . . . . *R. macrotis*, p. 276.
  - *b*. Ears shorter than the head.
    - *a'*. Lower lip with three vertical grooves; forearm 1·45. . . . . *R. minor*, p. 276.
    - *b'*. Lower lip with a single vertical groove; forearm 1·5 . . . . *R. hipposiderus*, p. 277

145. **Rhinolophus luctus.** *The great Eastern Horseshoe-Bat.*

Rhinolophus luctus, *Temm. Mon. Mam.* ii, p. 24, pl. 30 (1835); *Hutton, P. Z. S.* 1872, p. 694; *Blyth, Mam. Birds Burma*, p. 19; *Dobson, Mon. As. Chir.* p. 39; *id. Cat. Chir. B. M.* p. 105; *Anderson, Cat.* p. 107; *Scully, J. A. S. B.* lvi, pt. 2, p. 240.
Rhinolophus perniger, *Hodgs. J. A. S. B.* xii, p. 414; *Blyth, J. A. S. B.* xiii, p. 484; *id. Cat.* p. 23; *Jerdon, Mam.* p. 23.

This is the largest known species of the genus. The ears are very large, the tips acuminate and bluntly pointed, the outer margin concave below the tip and divided from the large and long antitragus by a deep re-entering angular notch.

Nose-leaf greatly developed and peculiar. The anterior leaf very large, projecting over the lip in front and at the sides, deeply incised in the middle. Sella expanded on each side of the base of the erect process into a rounded flat disk, one above each nostril. The transverse erect process is much higher than the short longitudinal posterior buttress, the free margin of the latter is rounded.

CSL

The posterior nose-leaf is long, it terminates in an acuminate blunt point between the ears, and its surface is complicated, being crossed by a flat diamond-shaped lamella above and by another lamella below.

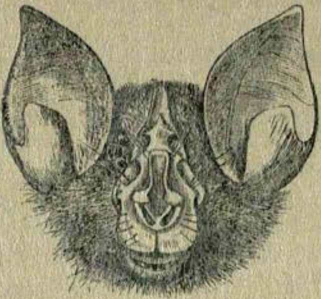

Fig. 82.—Head of *Rhinolophus luctus*. (From Guide to the Galleries of Mammalia, British Museum.)

Lower lip divided in the middle by a single deep groove. Wing-membrane greatly developed and attached to the base of the first or outer toe; interfemoral membrane large, projecting behind and terminating in a point at the tip of the tail, which does not extend outside the membrane. Fur of body very long and dense, soft and slightly curly. Premolars as in *R. cœlophyllus*.

Colour of the fur usually jet-black with ashy tips to the hairs, occasionally, it is said, reddish brown.

Dimensions of a large Himalayan specimen in alcohol: head and body 3·55 inches, tail 2·6, ear from head outside 1·25, forearm 2·95. Specimens from Southern India and Ceylon are rather smaller. The forearm in a series of specimens varies from 2·6 to 3 inches in length.

Distribution. The Himalayas at moderate elevations, the hill-ranges of Southern India and Ceylon, Burma, the Malay Peninsula and Archipelago, extending to Borneo and the Philippines. This bat appears to be restricted to the highlands of the countries inhabited.

Habits. Hodgson, in his original description of *R. perniger*, stated that it was shy, keeping to the forests and never approaching houses or cultivation; but Hutton, to whom we are indebted for a fuller account of the animal's habits, says that at Mussoorie he had taken specimens "hanging from the roof of an outhouse in which rabbits and firewood were kept, the bat looking, with its ample black wings folded round it as a cloak, somewhat like a large black cocoon."

Captain Hutton adds:—"This fine species commences its flight rather early in the evening, and does not soar high, like the smaller bats in general, but remains below at about twenty or thirty feet from the ground, wheeling with a somewhat heavy and noiseless flight around buildings and large trees in search of small beetles and other insects." . . . "This species appears usually to dwell in pairs, and does not associate in communities like some of the smaller *Rhinolophi*—though, in a large cavern, affording ample room for them to hang apart, several pairs may sometimes be found.

CSL

I have taken them from the roofs of outhouses, and in wide caves in limestone-rocks, but they appear to fly only during the warmer months of summer, remaining (at least such is the case at Mussoorie) in a semitorpid state during the winter."

146. **Rhinolophus cœlophyllus.** *The crosletted Horseshoe-Bat.*

Rhinolophus cœlophyllus, *Peters, P. Z. S.* 1866, p. 426, pl. xxxv *Blyth, Mam. Birds Burma*, p. 19; *Dobson, Mon. As. Chir.* p. 53; *id. Cat. Chir. B. M.* p. 104, pl. vii, fig. 1 (nose-leaf); *Anderson, An. Zool. Res.* p. 96; *id. Cat.* p. 107.

Ears large, with narrow acute tips directed outwards, outer margin concave below the tip, a deep re-entering angle between descending portion of the outer margin and the large antitragus.

Anterior nose-leaf well developed. Median leaf or sella expanded in front, covering the nostrils; the transverse erect process narrow, and the longitudinal erect crest thicker and higher than usual and the same height as the transverse process; the upper edge of the longitudinal process rounded, the posterior termination in a deep hairy subcruciform hollow, which occupies the middle of the posterior leaf. This latter is thick, pointed behind, nearly triangular in outline, the surface covered with long hairs. The lower lip divided by three grooves.

The wings are from the ankles or from just above them. Interfemoral membrane concave or straight behind; tip of the tail projecting. Second upper premolar separated from the canine by a space, in the middle of which stands the small first premolar; the second lower premolar minute and external to the tooth-row.

Colour of fur brown above, pale brownish white below, the hairs above are white at the base, brown at the extremity.

Dimensions. Length of head and body 2 inches, tail 0·8, ear outside from the head 0·6, forearm 1·85.

Distribution. Hitherto only found in Burma. This species has been procured in the Salween valley near Moulmein by Captain A. C. Beavan, and at Tsagain in Upper Burma by Dr. J. Anderson.

Nothing is known of the habits. The nose-leaf differs from that of any other species.

147. **Rhinolophus trifoliatus.** *The trefoil Horseshoe-Bat.*

Rhinolophus trifoliatus, *Temm. Mon. Mam.* ii, p. 27, pl. 31 (1835); *Dobson, Mon. As. Chir.* p. 41; *id. Cat. Chir. B. M.* p. 106; *Anderson, Cat.* p. 108.

Very similar to *R. luctus* in structure and even in the colour and length of the fur, but distinguished by its smaller size, by the erect transverse process of the sella being narrower above, and by the shape of the interfemoral membrane, the posterior margin of which is straight, with the extreme tip of the tail projecting. The specimens in the British Museum are from Borneo and are reddish brown in colour.

Dimensions. Head and body 2·3 inches long, tail 1·3, ear from head outside 0·9, forearm 2.

Distribution. A specimen from Assam, obtained by Mr. Peal, is in the Indian Museum; two others were obtained at Mergui by Mr. Hume; other localities recorded are India (eastern coast), Java, and Borneo.

148. **Rhinolophus mitratus.** *The mitred Horseshoe-Bat.*

Rhinolophus mitratus, *Blyth, J. A. S. B.* xiii, p. 483 (1844), xxii, p. 409, footnote; *id. Cat.* p. 23; *Jerdon, Mam.* p. 24; *Dobson, Mon. As. Chir.* p. 42; *id. Cat. Chir. B. M.* p. 107; *Anderson, Cat.* p. 108.

Ears large, pointed, outer margin very slightly convex, divided from the large antitragus by a shallow angular notch.

Anterior nose-leaf moderately developed; sella formed in front of two lappets, one over each nostril, together forming a cup-shaped depression, and behind of a small, erect, transverse process and of a still smaller and less elevated longitudinal lamella. Posterior nose-leaf subequilaterally triangular, sharply pointed. Lower lip with a single groove. Fur soft and rather long.

Colour of the fur rich light brown above, paler towards the base; below, the colour is much paler and the hair shorter.

Dimensions. Head and body 2·4 inches long, tail 1·6, ear (anteriorly) 1, forearm 2·25. Another specimen was smaller.

Distribution. Chybassa, S.W. Bengal (*Tickell*); Darjiling (*Dr. G. King*). Apparently rare.

149. **Rhinolophus pearsoni.** *Pearson's Horseshoe-Bat.*

Rhinolophus pearsonii, *Horsfield, Cat.* p. 33 (1851); *Blyth, J. A. S. B* xxii, p. 409; *id. Cat.* p. 24; *Jerdon, Mam.* p. 25; *Dobson, Mon. As. Chir.* p. 43; *id. Cat. Chir. B. M.* p. 108; *Anderson, An. Zool. Res.* p. 95, pl. iv, fig. 1; *id. Cat.* p. 109.

Rhinolophus larvatus, *M.-Edw. Rech. Mam.* p. 248, pl. xxxvii *a*, fig. 1, pl. xxxvii *c*, fig. 1.

Rhinolophus yunanensis, *Dobson, J. A. S. B.* xli, pt. 2, p. 336.

Ears large, acutely pointed; outer margin concave, separated at the base from the large antitragus by a deep angular notch.

Anterior nose-leaf large, concealing the upper lip when viewed from above; sella in front, between the nostrils, of moderate breadth, having a raised longitudinal rib in the middle; the erect portion at first the same breadth, then suddenly narrowing and rounded off above; the posterior longitudinal buttress-like lamella of the same height, with a rounded upper margin; posterior leaf subequilaterally triangular with straight sides. Lower lip with a single groove.

Wings very wide, wing-membrane from the ankles; posterior free margin of interfemoral membrane nearly straight, the extreme tip of the tail protruding. Fur very long, dense and soft.

Colour dark brown to light chestnut, lower parts sometimes greyer.

Dimensions. Head and body 2·7 inches, tail 0·9, forearm 2·2, ear from head outside 0·8.

Distribution. The Himalayas (Mussoorie, Darjiling) and their extension in Eastern Tibet; also the Assam ranges south of the Brahmaputra (Khási and Gáro hills), the Lushai hills, and Yunnan.

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150. **Rhinolophus affinis.** *The allied Horseshoe-Bat.*

Rhinolophus affinis, *Horsfield, Res. Java* (1824); ? *Cantor, J. A. S. B.* xv, p. 181; *Blyth, J. A. S. B.* xxi, p. 346; *id. Cat.* p. 24; *id. Mam. Birds Burma*, p. 20; *Jerdon, Mam.* p. 25; *Hutton, P. Z. S.* 1872, p. 696; *Dobson, Mon. As. Chir.* p. 47; *id. Cat. Chir. B. M.* p. 112; *Anderson, Cat.* p. 109; *Scully, J. A. S. B.* lvi, pt. 2, p. 242; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 261.

Rhinolophus rouxii, *Temm. Mon. Mam.* ii. p. 30 *b* (1835); *Blyth, ll. cc.*; *Jerdon, l. c.*; *Hutton, l. c.* p. 697.

Rhinolophus rubidus, R. cinerascens, *and* R. rammanika, *Kelaart, Prod.* pp. 13, 14.

Rhinolophus rubidus (*errore* fulvidus) and R. n. s., *Kelaart, apud Blyth, J. A. S. B.* xx, pp. 182–3.

Ears shorter than the head, sharply pointed, the outer margin nearly straight, separated from the large antitragus by a moderately deep angular notch.

Anterior nose-leaf not quite large enough to conceal the muzzle when viewed from above, but very broad between its own outer and inner margins; sella moderately broad in front between the nostrils, the erect transverse portion of the same breadth throughout as that between the nostrils and rounded above, the longitudinal lamellar buttress-like process behind being of the same height or slightly higher, and with a rounded upper surface from which a few long hairs arise (fig. 80 A, p. 268); posterior leaf longer than broad, with concave margins, the tip elongate, acuminate, and rather blunt. Lower lip with three grooves.

Wing-membrane broad, variously attached to the tarsus, the ankle, or to the tibia above the ankle. Interfemoral membrane nearly straight behind or projecting angularly in the middle. Fur dense, soft, moderately long.

Colour very variable, from dark sooty brown or even dark ashy to bright ferruginous or golden orange-brown, the hairs darker towards their extremities.

Dimensions. Head and body 2·3 inches long, tail 0·9, ear from head between ears 0·6, from base of inner margin 0·75, forearm 2·1, thumb 0·35.

Distribution. Peninsula of India from the Himalaya to Cape Comorin, ascending the Himalayas to 7000 feet (Mussoorie, Nepal, Darjiling), Ceylon, Burma, Cochin China, Sumatra, Java, and Borneo. Probably chiefly found in those parts of India that have a heavy rainfall; no specimens appear to be recorded from the Central Provinces, Coromandel Coast, N.W. Provinces, or Punjab. Dobson states that this bat inhabits the hill-tracts, but specimens are recorded by Blyth from Calcutta and Barrackpur, and from a cave near Colgong on the Ganges, and by Jerdon from Tellicherry.

Habits. The only account I can find is given by Hutton, who says:—"This species is early on the wing and may be seen in the evening twilight coursing slowly round the trees in search of insects, crunching the hard-winged beetles as it flies, with a sharp crackling sound. It often flies so low as to be easily caught in a common butterfly net." Of *R. rouxi*, which, as Dobson has shown, is merely a lighter-coloured variety of *R. affinis*, Hutton remarks that at Mussoorie it makes its appearance as early as March, remaining inactive during the winter.

151. **Rhinolophus andamanensis.** *The Andaman Horseshoe-Bat.*

Rhinolophus andamanensis, *Dobson, J. A. S. B.* xli, pt. 2, p. 337 (1872); *id. Mon. As. Chir.* p. 46; *id. Cat. Chir. B. M.* p. 113; *Anderson, Cat.* p. 110.

Like *R. affinis* generally, but the anterior horseshoe-shaped membrane is very large, completely concealing the muzzle when viewed from above, as in *R. pearsoni*; the posterior terminal leaf is also much longer, produced backwards between the ears, and not concave on the sides as in *R. affinis*. The thumb is also much longer.

Colour of fur bright reddish brown above and below.

Dimensions. Length of an adult male preserved in alcohol: head and body 2·5 inches, tail 0·9, ear (from origin of outer margin) 0·85, forearm 2·05, thumb 0·45.

Distribution. A single specimen in the Indian Museum, Calcutta, was obtained on the Southern Andaman Island. The above description is copied from Dobson; I have not been able to examine a specimen.

152. **Rhinolophus petersi.** *Peters's Horseshoe-Bat.*

Rhinolophus petersii, *Dobson, J. A. S. B.* xli, pt. 2, p. 337 (1872); *id. Mon. As. Chir.* p. 49; *id. Cat. Chir. B. M.* p. 114; *Hutton, P. Z. S.* 1872, p. 700; *Anderson, Cat.* p. 110; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 261.

Ears moderate, subacutely pointed, outer margin concave, separated from the large antitragus by a moderately deep angular notch.

Anterior nose-leaf moderate, not nearly covering the muzzle. Sella of uniform breadth from between the nostrils to the rounded extremity of the erect transverse process; to this is attached posteriorly a longitudinal buttress-like lamella, the convex upper margin of which exceeds the transverse portion in height. Posterior leaf a little longer than broad, with concave sides and a subacute tip. Lower lip with three grooves.

Wing-membrane from the ankles; interfemoral membrane nearly square behind, the tip of the tail projecting slightly. Fur long and soft.

Colour of fur varying from greyish mouse-colour to brown, generally paler and greyer below.

Dimensions. Head and body 2·5 inches, tail 1, ear (from head between ears) 0·55, from base 0·75, forearm 2.

Distribution. Mussoorie (Hutton), and Coonoor, Nilgiri hills, South India (W. Davison).

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Habits. At Mussoorie, where it is not common, Peters's leaf-nosed bat is said by Hutton to be found only during the warm summer months. It hides in caves &c. during the day and flies in the evening high and rapidly as a rule, though it is occasionally seen hunting over beds of flowers.

153. **Rhinolophus macrotis.** *The large-eared Horseshoe-Bat.*

Rhinolophus macrotis (*Hodgson*), *Blyth, J. A. S. B.* xiii, p. 485 (1844); *id. Cat.* p. 25; *Jerdon, Mam.* p. 26; *Hutton, P. Z. S.* 1872, p. 699; *Dobson, Mon. As. Chir.* p. 45; *id. Cat. Chir. B. M.* p. 110; *Anderson, Cat.* p. 109; *Scully, J. A. S. B.* lvi, pt. 2, p. 241.

Ears very large, their length exceeding that of the head, bluntly pointed; outer margin slightly concave.

Anterior nose-leaf large, covering the upper lip; sella broad, rounded in front, maintaining the same breadth throughout the erect transverse portion, which is rounded above, and supported behind by a longitudinal buttress-like connecting process, hairy, equal or slightly superior to the transverse process in height, obtusely rounded above; posterior leaf triangular, obtusely pointed, subequilateral. Lower lip with three grooves across it.

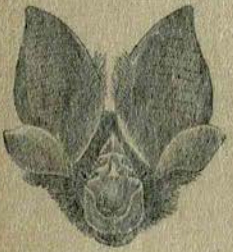

Fig. 83.—Head of *R. macrotis*. (Dobson, Mon. As. Chir.)

Wing-membrane from the ankles; interfemoral membrane generally pointed and projecting in the middle, but sometimes straight; the extreme tip of the tail free. Fur moderately long.

Colour sooty brown varying to light earthy brown (and probably to bright chestnut) above, paler and greyer below.

Dimensions. Head and body 1·7 inches long, tail 0·8, ear from crown of head 0·75 (from base 0·85), forearm 1·6. In fresh specimens the ear is an inch long according to Hutton and from nose to tail 2·5.

Distribution. Hitherto only recorded from two Himalayan localities, Nepal and Mussoorie. At the last-named locality one was captured at 5500 feet.

Habits. Hutton says of these bats, "They come out of caves in the earlier twilight hours, and may be seen flitting rapidly at some height in the air, chasing the small flies and beetles which abound during the rainy season."

154. **Rhinolophus minor.** *The little Indian Horseshoe-Bat.*

Rhinolophus minor, *Horsfield, Res. Java* (1824); *Blyth, J. A. S. B.* xxi, pp. 347 note, 361; *Hutton, P. Z. S.* 1872, p. 698; *Dobson, Mon. As. Chir.* p. 50; *id. Cat. Chir. B. M.* p. 114; *id. Report Brit. Assoc.* 1880, p. 175; *Anderson, Cat.* p. 110; *Scully, J. A. S. B.* lvi, pt. 2, p. 243; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 261.

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? Rhinolophus lepidus, *Blyth, J. A. S. B.* xiii, p. 486 (1844).
Rhinolophus subbadius, *Blyth, J. A. S. B.* xiii, p. 486, xxi, pp. 347, 361; *id. Cat.* p. 25; *Jerdon, Mam.* p. 26, *nec Hodgson.*
Rhinolophus pusillus, *Dobson, P. A. S. B.* 1872, p. 155; *Blyth, Mam. Birds Burma*, p. 20, *nec Temminck.*
Rhinolophus garoensis, *Dobson, J. A. S. B.* xli, pt. 2, p. 387; *id. Mon. As. Chir.* p. 48; *id. Cat. Chir. B. M.* p. 115; *Anderson, Cat.* p. 110.

Ears a little shorter than the head, subacutely pointed, outer margin concave just below the tip.

Anterior nose-leaf deep from outer to inner margin, but not large enough to conceal the muzzle when viewed from above; sella somewhat broader in front, the erect transverse process a little narrower than that between the nostrils, and rounded off above, the longitudinal buttress-like lamella behind much higher than the transverse process, and pointed above (more pointed in some specimens than in others); posterior leaf longer than broad in general, and with the sides concave and the tip acuminate, but this is variable also, and in one variety (*R. garoensis*, fig. 84) the posterior leaf is almost an equilateral triangle with straight sides. Lower lip with three grooves.

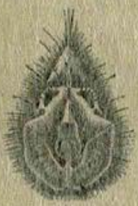

Fig. 84.—Nose-leaf of *R. minor*, var. (Dobson, Mon. As. Chir.)

Wings from the ankles. Interfemoral membrane straight or nearly so behind, but somewhat variable. Fur moderately long.

The second lower premolar is sometimes in the tooth-row, more often, as in most other species, external, wedged in between the outer angles of the adjoining teeth.

Colour of fur light brown above, greyish brown below, varying in tint as usual.

Dimensions. Head and body 1·75 inches, tail 0·75, ear from crown of head 0·45, from base 0·55, forearm 1·45.

Distribution. The Himalayas (Mussoorie, Nepal), Gáro hills, the Wynaad and Malabar Coast, and probably the neighbourhood of Calcutta (*R. lepidus*), Burma, Siam, Sumatra, Java, Borneo, and Japan. Apparently rare in the Peninsula of India. The Himalayan and Gáro form is that with the triangular posterior nose-leaf, fig. 84 (*R. subbadius*, Blyth, or *garoensis*, Dobson).

155. **Rhinolophus hipposiderus.** *The lesser Horseshoe-Bat.*

Noctilio hipposideros, *Bechstein, Naturg. Deutschl.* edit. 2, i, p. 1194 (1801).
Rhinolophus hipposideros, *Dobson, Mon. As. Chir.* p. 52; *id. Cat. Chir. B. M.* p. 117; *Scully, P. Z. S.* 1881, p. 198.

Ears nearly as long as the head, very pointed, the outer margin deeply concave and separated from the large antitragus by a deep angular notch.

Anterior nose-leaf broad from the nostrils to the margin, but not concealing the muzzle; sella of moderate breadth where flat, the erect transverse portion gradually becoming narrower, rounded at top; the hinder longitudinal buttress-like lamella hairy, pointed, scarcely exceeding the transverse portion in height; posterior leaf longer than broad, with the sides slightly concave and the tip blunt (fig. 80 B, p. 268). Lower lip with a single groove.

Wings from the ankles; interfemoral membrane projecting angularly behind; extreme tip of the tail free.

Colour of fur light brown above, light greyish brown below. Young animals often darker.

Dimensions. Head and body 1·55 inches, tail 1·15, ear from origin of outer margin 0·6, from head between ears 0·55, forearm 1·5.

Distribution. In India this species has only been observed in Gilgit, where Scully found it fairly common in the warm valleys 4000 to 6000 feet above sea-level, during the summer months. It is also met with throughout the greater part of the Palæarctic region, extending in Western Europe as far north as the shores of the Baltic.

Habits. During the day *R. hipposiderus* hides in caves, ruined buildings, outhouses &c., often in large numbers. It usually appears abroad about dusk, and according to Scully has a powerful and long sustained flight, but Blasius says its flight is rather irregular and fluttering. It flies generally higher in the air than *R. ferrum-equinum*, and is more frequently found away from dense tree-growth.

156. **Rhinolophus ferrum-equinum.** *The greater Horseshoe-Bat.*

Vespertilio ferrum-equinum, *Schreb. Säugeth.* i, p. 174, pl. lxii (1775).

Rhinolophus ferrum-equinum, *Dobson, Mon. As. Chir.* p. 53; *id. Cat. Chir. B. M.* p. 119, partim; *Scully, P. Z. S.* 1881, p. 199.

Ears nearly equal to the head in length, sharply pointed; the outer margin concave just below the tip and separated below by a shallow obtuse notch from the moderately large antitragus.

Nose-leaf rather small, anterior horseshoe broad from nostrils to outer margin, but not nearly covering the muzzle; sella small, erect transverse process narrow, with the sides slightly concave and the top rounded; longitudinal buttress-like lamina behind a little higher than the transverse process, hairy and obtusely pointed; posterior leaf longer than broad, with concave sides and a blunt tip. Lower lip with a single groove.

Wings from the ankles, interfemoral membrane projecting slightly in the middle behind; tip of the tail free.

The second upper premolar is close to the canine; the first premolar minute and external to the tooth-row; second lower premolar very minute, often not to be detected, lying in the outer angle between the closely approximate first and third premolars.

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Colour of fur above reddish brown with a greyish tinge, beneath pale grey, almost white.

Dimensions. Head and body 2·35 inches, tail 1·55, ear from anterior base 0·9, from crown of head 0·75, forearm 2·25.

Distribution. Europe, Africa, and Asia north of the Himalayas, not ranging quite so far north as *R. hipposiderus*, but extending to the Cape of Good Hope. Within Indian limits this species has, like *R. hipposiderus*, only been found in Gilgit.

Habits. In the day the greater horseshoe-bat hides in dry caves, outhouses, ruins, and similar places, like so many of the other *Rhinolophi*; it appears rather late in the evening, flies low, and keeps much about trees. Its flight is less well sustained than that of *R. hipposiderus*. Scully found it very common in the low hot valleys of Gilgit from about the middle of April to the end of September, its vertical range being from about 4500 to 5500 feet.

157. **Rhinolophus tragatus.** *Hodgson's Horseshoe-Bat.*

Rhinolophus tragatus, *Hodgson, J. A. S. B.* iv, p. 699 (1835); *Blyth, J. A. S. B.* xiii, p. 484, xxii, p. 409, note; *id. Cat.* p. 24; *Jerdon, Mam.* p. 24; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 263.

Rhinolophus ferrum-equinum, *Dobson, P. A. S. B.* 1872, p. 208; *id. Mon. As. Chir.* p. 53; *id. Cat. Chir. B. M.* p. 119, partim; *Hutton, P. Z. S.* 1872, p. 698; *Anderson, Cat.* p. 111, partim *Scully, J. A. S. B.* lvi, pt. 2, p. 245; *nec Schreber.*

? Rhinolophus brevitarsus*, *Blyth, Cat.* p. 24, no description.

This species, which was by Dobson united to *R. ferrum-equinum*, resembles that bat closely in all characters except in having three grooves instead of one on the lower lip, as was observed by Blyth (J. A. S. B. xxii, p. 409). The nose-leaf is considerably broader as a rule, but there is some variation in this respect. In structure, with the above exception, colour and dimensions the characters of the last species apply to the present. Pubic teats greatly developed.

Distribution. The Himalayas from Mussoorie to Sikhim, and from a moderate elevation to 6000 or 7000 feet.

Habits. According to Hodgson this bat emerges from the rock-cavities in which it passes the day sooner in the evening than the *Vespertilionidæ* and always in considerable numbers. It is not migratory and does not hibernate. It breeds once in the year towards the close of summer and produces two young.

The only Asiatic *Rhinolophi* not found in India are two Western forms, *R. euryale* and *R. blasii*, *R. acuminatus* known only from Java, and two Philippine species. The remaining members of the genus are African or Australian, mostly the former.

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* Founded on a dried specimen in bad condition, perhaps referable to *R. minor* (see Dobson, Cat. As. Chir. p. 197, no. 197).

CSL

Subfamily HIPPOSIDERINÆ.

This subfamily is distinguished from the *Rhinolophinæ* by having only two phalanges in all the toes (a character exhibited by only one other bat, the American *Thyroptera tricolor*), by the absence of a notch in the outer border of the ear, and consequently by having no distinct antitragus, and by the shape of the nose-leaf, the posterior portion of which is not triangular. Another peculiarity, unknown amongst other Chiroptera, is the existence of a second pair of large foramina in the pelvis, besides the usual thyroid or obturator foramina. The second foramen is preacetabular, and formed by the ileo-pectineal spine being united by a bony isthmus with a process derived from the antero-inferior surface of the ilium. This character, Dobson points out, greatly strengthens the pelvis, which is remarkably weak in bats, but it is not known whether any peculiarity in the habits of *Hipposiderus* and its allies corresponds to the increased strength of the pelvic girdle.

Two genera of the *Hipposiderinæ* occur in India and a third is known from Persia and may probably occur in Baluchistan. These genera may thus be distinguished:—

A. No flat expanded lamina between the nostrils; a transverse swollen bar behind them.	
a. Anterior nose-leaf or horseshoe not divided in the middle	HIPPOSIDERUS.
b. Anterior nose-leaf divided into two distinct lappets	CŒLOPS.
B. A flat expanded lamina between the nostrils, no transverse bar behind them	TRIÆNOPS.

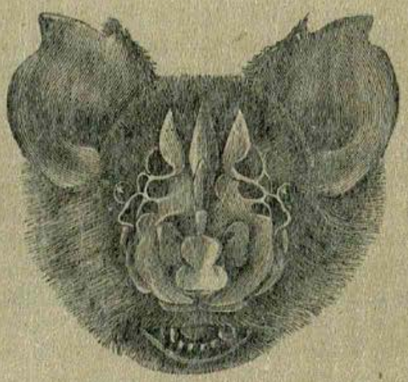

Fig. 85.—Head of *Triænops persicus*, ×2. (Dobson, Mon. As. Chir.)

Triænops persicus has been found in Persia at Shiráz, and in East Africa. Should it occur within Indian limits, the accompanying woodcut will enable it to be easily recognized. It is a pale buff bat, with the forearm 2 inches long.

CSL

Genus **HIPPOSIDERUS**, Gray (1831).

Syn. *Phyllorhina*, Bonaparte (1837), *nec* Leach; *Asellia*, &c., Gray.

The nose-leaf more or less square or oblong in form, and complicated, consisting of three portions—anterior, median (or *sella*), and posterior; the anterior horseshoe-shaped or semicircular as in *Rhinolophus*, resting flatly on the muzzle, but without any deep incision, and, in most species, without even a notch, in front. The nostrils open freely in the middle of the horseshoe, each is generally partly or wholly surrounded by a lamina, and there is a more or less pronounced longitudinal ridge between them. On each side of the horseshoe there are, in several species, supplementary leaflets forming a fringe. The sella does not come forward between the nostrils; it is a prominent transverse bar behind them and divides the horseshoe in front from the posterior leaf behind. The latter is never triangular: the hinder margin is simply rounded in most species, tricuspid in a few; it is usually bent forward over the front surface of the leaf, which is generally divided into shallow cells (as a rule four in number) by longitudinal (antero-posterior) ribs (fig. 80 C, p. 268). Behind the nose-leaf there is, in the males of several species, and to a smaller degree in females, a large pore, being the orifice of a glandular sac, which the animal can evert at pleasure like the finger of a glove; the opening is marked by a pencil of stiff hairs. At the sides of the posterior leaf and above the eyes are one or more wart-like prominences, sometimes bearing pores; in some species these prominences form a kind of fringe to the posterior nose-leaf.

Dentition: i. $\frac{2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. First upper premolar minute, blunt, in the outer angle between the canine and second premolar, rarely deciduous except in *H. tridens* and one other species (not Indian), in which adults have pm. $\frac{1-1}{2-2}$.

I have explained at full length elsewhere (P. Z. S. 1887, p. 637) the reasons that have induced me to employ the name *Hipposiderus* for this genus instead of *Phyllorhina*, which is adopted by Dobson and others.

The genus *Hipposiderus* ranges throughout the tropical and subtropical parts of Asia (including the Malay Archipelago), Africa, and Australasia. It is not Palæarctic like *Rhinolophus*, nor is it by any means restricted in India to the hills and highlands. The Indian species are not quite so numerous as those of *Rhinolophus*, but they are more generally diffused.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Size large, forearm exceeding 3 inches.
  a. A large frontal glandular sac; posterior leaf narrower than horseshoe; forearm about 3·5 .... *H. armiger*, p. 283.
  b. No frontal sac; posterior leaf not narrower than horseshoe; forearm about 3·4 .... *H. diadema*, p. 284.

B. Size small, forearm less than 3 inches.
  a. Posterior margin of nose-leaf terminating in three sharp points; forearm 1·75 .... *H. tridens*, p. 282.
  b. Posterior margin of nose-leaf rounded.
    a′. Three supplementary leaflets on each side of the horseshoe.
      a″. Surface of posterior leaf divided into 2 cells; forearm 2·6 ...... *H. nicobarensis*, p. 286.
      b″. Surface of posterior leaf divided into 4 cells.
        α. Posterior leaf narrower than horseshoe; forearm 2·45 .... *H. leptophyllum*, p. 284.
        β. Posterior leaf as wide as horseshoe or wider.
          α′. Hinder margin of interfemoral membrane straight; forearm 2 .... *H. speoris*, p. 287.
          β′. Hinder margin of interfemoral membrane forming a salient angle; forearm 2·25 *H. larvatus*, p. 288.
    b′. Two supplementary leaflets; forearm 1·75 .... *H. galeritus*, p. 287.
    c′. No supplementary leaflets.
      a″. Ears laid forward extend to muzzle: forearm 1·55 .... *H. bicolor*, p. 289.
      b″. Ears do not extend to muzzle; forearm 1·4 .... *H. amboinensis*, p. 290.

158. **Hipposiderus tridens.** *The trident leaf-nosed Bat.*

Rhinolophus tridens, *Geoffroy, Descr. de l'Egypte*, ii, p. 130 (1813).
Phyllorhina tridens, *Dobson, Cat. Chir. B. M.* p. 131.
Phyllorhina tridens, var. murraiana, *Anderson, Cat.* p. 113; *Murray, Vert. Zool. Sind*, p. 6, pl. i, fig. 2 (head).

Ears of moderate size, tips pointed, outer margin slightly concave above, then convex, inner margin very convex. Anterior nose-leaf or horseshoe semicircular, having, on each side, two secondary leaflets; sella prominent, trilobate; posterior leaf having the surface divided into four cells by three longitudinal ribs, and terminating above on the forehead in three thickened and pointed projections.

Wings from the lower third of the tibia; interfemoral membrane short, square behind; the last two vertebræ of the tail and sometimes part of the penultimate free. First minute upper premolar deciduous.

Colour of fur above greyish brown, the basal portion paler, sometimes white; beneath wholly yellowish white or pure white.

Dimensions of a Karáchi specimen: head and body 2·3 inches, tail 1, ear from origin of outer margin 0·75, forearm 2·1. African specimens are smaller.

Distribution. Sind; procured in Karáchi by Mr. J. Murray, who observed it in April about dusk in large numbers. Also found in Southern Persia, Mesopotamia, Egypt, and Zanzibar.

The variety called *murraiana* by Anderson is larger, its ears are somewhat shorter, broader, and less pointed, and its wing and interfemoral membranes are attached rather lower on the tibia. One or two other small differences are noted, but they are not of much importance.

159. **Hipposiderus armiger.** *The great Himalayan leaf-nosed Bat.*

Rhinolophus armiger, *Hodgson, J. A. S. B.* iv, p. 699 (1835).
Hipposideros armiger, *Blyth, J. A. S. B.* xiii, p. 488; *id. Cat.* p. 25; *Jerdon, Mam.* p. 27.
Hipposideros diadema, *Cantor, J. A. S. B.* xv, p. 181, *nec Geoffroy.*
Phyllorhina armigera, *Hutton, P. Z. S.* 1872, p. 700; *Dobson, P. Z. S.* 1873, p. 242; *id. J. A. S. B.* xliii, pt. 2, p. 234; *id. Mon. As. Chir.* p. 64; *id. Cat. Chir. B. M.* p. 135; *Anderson, Cat.* p. 114; *Scully, J. A. S. B.* lvi, pt. 2, p. 245.

Ears moderate, tips blunt, outer margin slightly concave near the tip, then moderately convex, inner margin convex.

Nose-leaf large; anterior leaf shield-shaped, with four supplementary leaves on each side; sella trilobate, posterior leaf narrower than the anterior (exclusive of the lateral leaflets), the surface divided into four cells as usual, the hinder margin sinuate, slightly elevated at the centre and at both ends (fig. 80 C, p. 268). There is a well-marked frontal sac with a transverse opening; this sac is much developed in old males, in which it forms the apex of a swollen fleshy naked area bordering the posterior leaf behind and on the sides. In females there are only wart-like elevations on each side above the eyes.

Wing-membrane from the tibia a little above the ankle; interfemoral membrane projecting triangularly behind; extreme tip of tail free. Fur soft and thick.

Colour of fur varying from light to dark brown, generally dark brown, a little paler below. The hairs of the back, in some cases at all events, are brown at the base, then whitish, and darker brown at the tips.

Dimensions of a large male: head and body 4·2 inches long, tail 2·1, ear from origin of outer margin 1·15, from crown of head 0·95, forearm 3·8. In a female the head and body are 3·5, tail 2·2, forearm 3·3 inches. This is the largest of Indian *Rhinolophidæ* and is only exceeded in size by one species of the family, the African *H. commersoni.*

Distribution. Himalayas (Mussoorie, Nepál, Sikhim); Khási hills, also Penang, Cochin China, and China. Ceylon is given by Dobson as a locality, but I am unable to discover the authority *. This bat probably inhabits Burma.

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* Perhaps Blyth, J. A. S. B. xxi, p. 346, where *H. lankadiva*, Kelaart, was identified with *H. armiger*. But the specimens referred to by Blyth in the passage have been identified by Dobson with *H. diadema*, Mon. As. Chir. p. 200.

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Habits. Hutton describes this species as not enveloping itself so completely in its wings, when suspended by its feet, as *Rhinolophi* do, and as keeping the tail and interfemoral membrane turned up over the lower part of the back. He observed specimens at Mussoorie in a loft, whence they issued before dark, or, during cloudy and misty weather, before sunset, and flew with a slow steady flight about the trees, capturing beetles and *Cicadæ*. The latter, as Hutton remarks, are peculiarly noisy just after sunset in the rainy season and thus are easily found by the bats.

When this bat is captured alive, Hutton says, the large ears are kept in a constant state of rapid tremulous motion, and the animal emits a low purring sound, which becomes a sharp squeak under the influence of alarm or irritation. The tremulous motion of the ears is common to the majority of insectivorous bats.

According to Hodgson *H. armiger* breeds once a year and produces two young towards the close of summer.

160. **Hipposiderus leptophyllum.** *Dobson's leaf-nosed Bat.*

Phyllorhina leptophylla, *Dobson, J. A. S. B.* xliii, pt. 2, p. 234 (1874); *id. Mon. As. Chir.* p. 66; *id. Cat. Chir. B. M.* p. 136; *Anderson, Cat.* p. 114.

"Ears rather large, broad and triangular, with subacute tips, the outer margin slightly concave beneath the tip. The upper (posterior) transverse nose-leaf small, upper edge simple, narrower than the horseshoe portion, thin, the three vertical folds in front faintly discernible at the base only; the horseshoe with a small incision in the centre of its front free edge; frontal pore small, placed at some distance behind the transverse nose-leaf.

"Wing-membranes from the tibia, a short distance above the ankle; interfemoral membrane triangular, the extremity of the tail projecting.

"Fur and integuments dark throughout.

"Distinguished from *H. armiger* by its considerably smaller size, by the upper transverse nose-leaf being simple, not lobed above as in that species, and by the incised front edge of the horseshoe, which in *H. armiger* is invariably plain.

"Length (of an adult male preserved in alcohol): head and body 2·5 inches, tail 1·65, ear (from origin of outer margin) 0·9, forearm 2·45." (*Dobson.*)

Distribution. The Khási hills, where a single specimen was obtained by Col. H. H. Godwin-Austen. No other is known. The above is copied from Dobson's description.

161. **Hipposiderus diadema.** *The large Malay leaf-nosed Bat.*

Rhinolophus diadema, *Geoffroy, Ann. Mus. Hist. Nat.* xx, p. 263 (1813).

Rhinolophus nobilis, *Horsfield, Res. Java* (1824).

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Hipposideros nobilis, *Cantor, J. A. S. B.* xv, p. 182; *Blyth, J. A. S. B.* xxi, p. 346; *id. Cat.* p. 26.
Hipposideros lankadiva, *Kelaart, Prod.* p. 19; *Blyth, J. A. S. B.* xx, p. 183; *id. Cat.* p. 26.
Phyllorhina masoni, *Dobson, J. A. S. B.* xli, pt. 2, p. 338.
Phyllorhina diadema, *Dobson, Mon. As. Chir.* p. 61; *id. Cat. Chir. B. M.* p. 137; *Blyth, Mam. Birds Burma*, p. 20; *Anderson, Cat.* p. 115.
Hipposiderus diadema, *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 263.

Ears pointed, outer margin nearly or quite straight below the tip.

Anterior nose-leaf about the same width on the face as the posterior, almost semicircular, with three supplementary leaflets on each side. Sella with a prominent ridge in the middle. Posterior leaf with a rounded free margin, slightly prominent and thickened in the middle, the front surface divided into four cells by longitudinal ribs as usual. No frontal pore. Wings from the ankles; interfemoral membrane large, projecting triangularly behind; last caudal vertebra free.

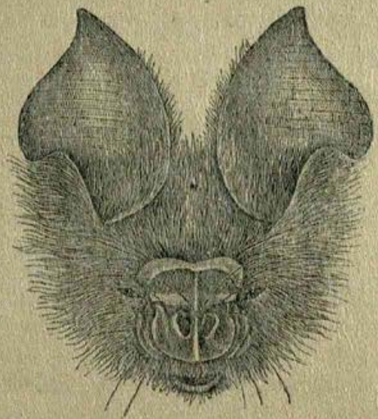

Fig. 86.—Head of *Hipposiderus diadema*, var. (*H. masoni*). (Dobson, Mon. As. Chir.)

Colour. Fur various shades of brown above, paler below. The basal and terminal portions of the dorsal hair brown, intermediate parts paler, sometimes white.

Dimensions. Head and body 3·4 inches, tail 2·3, ear from the crown 0·9, forearm 3·4 (varying from 3 to 3·6).

Distribution. In the Indian Peninsula this species has been found by Mr. V. Ball at Udaipur, north-west of Sambalpur, Central Provinces, and by myself near Bhandára east of Nágpur; remains also occur fossil in the Kurnool caves (Pleistocene). Other localities are Ceylon, Sikhim, Moulmein, Penang, and most of the islands in the Malay Archipelago, also the Philippines.

A specimen (fig. 86) from Moulmein, which differs in having the posterior nose-leaf divided into two cells only and in having a small bony process from the symphysis of the mandible, was separated by Dobson as *Phyllorhina masoni*; but in his British Museum Catalogue he states that the differences are probably merely individual peculiarities.

Habits. This species, like other members of the genus, haunts rocky caves, old tombs, and other buildings; Kelaart found it swarming in a tunnel cut through a rocky hill near Kandy.

162. **Hipposiderus nicobarensis.** *The Nicobar leaf-nosed Bat.*

Phyllorhina nicobarensis, *Dobson, J. A. S. B.* xl, p. 262, pl. xx, fig. 2 (1871); *id. Mon. As. Chir.* p. 63; *id. Cat. Chir. B. M.* p. 138; *Anderson, Cat.* p. 115.

"Ears large, acutely pointed, outer margin slightly concave beneath the tip; no frontal sac behind the nose-leaf; upper margin of the transverse leaf simple, forming an arc of a circle, folded back (? forward) and overhanging the concave front surface, which is divided into *two cells only* by a single central vertical ridge; in front the margin of the horseshoe has three small points.

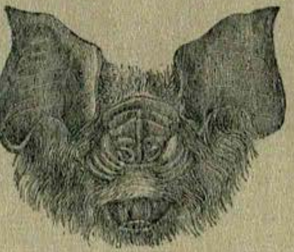

Fig. 87.—Head of *Hipposiderus nicobarensis.* (Dobson, Mon. As. Chir.)

"Wing-membrane from the base of the metatarsal bone of the outer toe; tail of six vertebræ, the last free.

"Fur above light brown at the base, then greyish brown, with light brown extremities; beneath pale brownish grey."

Dimensions. Head and body 3 inches, tail 1·7, ear from origin of outer margin 0·9, forearm 2·6.

Distribution. Nicobar Islands. The only specimen known was procured by Dr. Stoliczka and is preserved in the Indian Museum, Calcutta.

The above description is copied from Dobson; the form resembles *H. diadema*, but is distinguished by the posterior leaf being only divided into two cells, by the different attachment of the wing-membrane, and by much smaller size. From the figures it appears that there are three supplementary leaves on each side of the horseshoe, and the sella appears to have a prominent median ridge.

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163. **Hipposiderus galeritus.** *Cantor's leaf-nosed Bat.*

Hipposideros galeritus, *Cantor, J. A. S. B.* xv, p. 183 (1846).
Phyllorhina brachyota, *Dobson, J. A. S. B.* xliii, pt. 2, p. 237.
Phyllorhina galerita, *Dobson, Mon. As. Chir.* p. 69; *id. Cat. Chir. B. M.* p. 141; *Anderson, Cat.* p. 116.

Ears comparatively short and broad, outer margin concave below the blunt tip, then convex, inner margin very convex.

Anterior nose-leaf well developed, extending almost to the end of the muzzle, and having two secondary leaflets on each side; sella broad, with a slightly prominent ridge in the middle; posterior leaf evenly rounded behind, the surface divided into four cells by longitudinal ribs. Frontal sac distinct in males, just behind the posterior leaf, very indistinct in females.

Thumb and foot small; wing from the metatarsus, between the ankle and the base of the toes; interfemoral membrane broad, projecting triangularly behind; tip of the tail free. Second upper premolar more distant from the canine than usual in this genus; first premolar minute.

Colour of fur deep reddish brown above, paler beneath, the fur on the shoulders and along the spine darkest. The dorsal hairs are light brown at the base, the terminal third dark brown, the extreme tips paler again. Bright ferruginous specimens also occur.

Dimensions. Head and body 2 inches, tail 1·4, ear from crown 0·4, forearm 1·75.

Distribution. This form appears to be very rare west of the Bay of Bengal; it has been found in Ceylon and at one locality in the Indian Peninsula, Lingasugúr, N.N.W. of Bellary. It has been recorded from Penang, Singapore, Java, and Borneo.

Dobson notices some variation in the size of the nose-leaf, length of the tail, and place of attachment of the wing-membrane.

164. **Hipposiderus speoris.** *Schneider's leaf-nosed Bat.*

Vespertilio speoris, *Schneider, Schreber, Säugth. Supp.* pl. 59 B; *Geoff. Ann. Mus.* xx, p. 261 (1813).
Rhinolophus dukhunensis, *Sykes, P. Z. S.* 1831, p. 99.
Rhinolophus speoris, *Elliot, Mad. Jour. L. S.* x, p. 98.
Hipposideros speoris, *Blyth, J. A. S. B.* xiii, p. 489, xxi, p. 347; *id. Cat.* p. 26; *Jerdon, Mam.* p. 27.
Hipposiderus speoris, H. templetoni, H. aureus, *and* H. blythii, *Kelaart, Prod.* pp. 17, 18, 20.
Phyllorhina speoris, *Dobson, Mon. As. Chir.* p. 67; *id. Cat. Chir. B. M.* p. 143; *Blyth, Mam. Birds Burma,* p. 21; *Anderson, An. Zool. Res.* p. 97; *id. Cat.* p. 116.

Ears broad, pointed, outer margin concave below the tip, then convex, and having a small spine-like projection about one third the distance from the base to the tip (in the same position as the notch in *Rhinolophus*); upper third of inner margin nearly straight, lower two thirds very convex.

Anterior nose-leaf not covering the end of the muzzle, having three supplementary leaflets on each side; sella broad; posterior leaf evenly rounded behind, the surface divided into four cells by longitudinal ridges. Frontal sac well developed. Wing-membranes from the tibia near the ankle. Interfemoral membrane short, square behind; the end of the tail projecting.

Colour of fur above brown, varying from bright golden-brown to mouse-colour, the hairs white at the base; below, the tint is similar but paler.

Dimensions. Head and body 2·4 inches, tail 0·85, ear from crown 0·5, forearm 2.

Distribution. Throughout the greater part of India, specimens having been obtained from Dehra Dun, from Chánda and other localities in the Deccan, and from several places in Southern India (Madras, Nellore, Trichinopoly, Travancore, &c.), where Jerdon says this bat is far from rare, inhabiting old buildings, wells, &c. It also appears to be common in Ceylon. It has been found at Prome in Burma, and has an extensive range in the Malay Archipelago.

As in so many other cases, nothing appears known of the habits of this common bat, except that it is found in caves and masonry-buildings, ruins, tombs, wells, &c.

165. **Hipposiderus larvatus.** *Horsfield's leaf-nosed Bat.*

Rhinolophus larvatus, vulgaris, deformis, *and* insignis, *Horsfield, Res. Java* (1824).
Hipposideros larvatus, *Blyth, J. A. S. B.* xiii, p. 488; *id. Cat.* p. 26.
Hipposideros vulgaris, *Blyth, J. A. S. B.* xiii, p. 488; *Cantor, J. A. S. B.* xv, p. 183.
Phyllorhina larvata, *Dobson, P. A. S. B.* 1872, p. 155; *id. J. A. S. B.* xliii, pt. 2, p. 235; *id. Mon. As. Chir.* p. 68; *id. Cat. Chir. B. M.* p. 145; *Blyth, Mam. Birds Burma*, p. 21; *Anderson, An. Zool. Res.* p. 97; *id. Cat.* p. 117.

Ears broad, pointed, outer margin concave below the tip, then convex; there is a slight thickening about one third the distance from the base, but no distinct projection as in *H. speoris.*

Anterior nose-leaf not covering the end of the muzzle and having three supplementary leaflets on each side; sella well developed, distinctly trilobed; posterior leaf rather broader than the horse-shoe, divided into four cells, hinder margin regularly rounded. A well-marked frontal sac in males, but much smaller in females. In some males the wart-like glandular prominences on each side of the posterior leaf are greatly developed, as in *H. armiger.* Wings from the ankle-joint, or from the tibia just above; interfemoral membrane projecting and triangular behind; extreme tip of tail free.

Colour of fur very variable, generally reddish brown, the base of the hairs paler.

Dimensions. Head and body 3 inches, tail 1·5, ear from crown 0·75, forearm 2·45.

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Distribution. Assam, Sylhet, and throughout Burma, also Siam and Java.

This species is closely allied to *H. speoris*, but distinguished by larger size, proportionally larger ears, and by the posterior margin of the interfemoral membrane forming a salient angle, instead of being straight.

166. **Hipposiderus bicolor.** *The bicoloured leaf-nosed Bat.*

Rhinolophus bicolor, *Temminck, Mon. Mam.* ii, p. 18 (1835–41).
Hipposideros fulvus *and* murinus, *Gray, Mag. Zool. Bot.* ii, p. 492 (1838); *Blyth, J. A. S. B.* xiii, p. 489, xxi, p. 347.
Rhinolophus murinus *and* fulgens, *Elliot, Mad. Jour. L. S.* x, p. 99.
? Rhinolophus subbadius, *Hodgson, J. A. S. B.* xiii, p. 486, *nec Blyth.*
Hipposideros murinus, *Cantor, J. A. S. B.* xv, p. 183.
Hipposideros ater, *Templeton, J. A. S. B.* xvii, p. 252.
Hipposideros fulvus, murinus, *and* atratus, *Kelaart, Prod.* pp. 15, 16.
Hipposideros cineraceus, *Blyth, J. A. S. B.* xxii, p. 410.
Hipposideros cineraceus *and* murinus, *Blyth, Cat.* p. 27; *Jerdon, Mam.* p. 28.
Phyllorhina fulva, *Dobson, P. A. S. B.* 1872, p. 155; *id. J. A. S. B.* xli, pt. 2, p. 220, xliii, pt. 2, p. 235; *id. P. Z. S.* 1873, p. 250; *Anderson, An. Zool. Res.* p. 98; *Scully, J. A. S. B.* lvi, pt. 2, p. 248.
Phyllorhina bicolor, *Hutton, P. Z. S.* 1872, p. 702; *Dobson, Mon. As. Chir.* p. 70; *id. Cat. Chir. B. M.* p. 148; *Anderson, Cat.* p. 117.
Hipposiderus bicolor, *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 262.

Ears extending to the end of the muzzle when laid forward, broad, with very blunt rounded tips, outer margin straight, not concave below the tip. A low raised band of skin connects the base of the ears across the crown of the head; this band is hairy and requires to be looked for.

Nose-leaf small, oblong; no secondary leaflets at the side of the horseshoe, which is of about the same width as the posterior leaf, or rather narrower; sella less broad transversely than the anterior leaf; posterior leaf rounded behind, the front surface concave, divided longitudinally into four cells. Frontal sac well developed in males, rudimentary in females.

Wing-membrane from the ankle or tarsus; interfemoral membrane projecting angularly slightly behind; tip of tail free.

Colour varying from golden chestnut to very dark reddish brown, almost black, above, paler, sometimes white, below. The fur is generally pure white, buffy white, or grey for three-quarters of its length, the tips reddish brown, or ashy brown, or blackish. Some specimens are brilliant golden or bright ferruginous. Dobson found that several golden-coloured specimens examined by himself were pregnant females, but males were subsequently obtained by Anderson in Burma exhibiting the same brilliant coloration, though both males and females were found in adjoining caves of the usual coloration, whitish fur with dark tips.

Dimensions. A male Burmese specimen measured:—head and body 1·75 inches, tail 1·15, ear from crown 0·75, forearm 1·55.

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Distribution. The Oriental region and part of the Australian. Throughout India from Sind, the Punjab, and North-west Himalayas, below about 5000–6000 feet, to Cape Comorin; also in Ceylon, Assam, Burma, &c.

Varieties. Dobson recognizes four varieties, chiefly distinguished by the size of the ears. One of these, however, *H. amboinensis*, with the shortest ears of all, is altogether smaller in size, and must I think, from its distribution throughout the same area, be kept distinct. Of the other varieties, one, *H. aruensis*, is not Indian; whilst the typical *H. bicolor*, with ears as long as the head, has only been found within our area in the Nicobar Islands; *H. fulvus*, with ears longer than the head, being the common Indian and Burmese form.

Habits. Scarcely any information is available. This species lives during the day in caves, old tombs, and other buildings, like most members of the family. If Dobson's suggestion be correct, the golden colour observed in some members of this species is assumed during the breeding-season only, and, if so, it is a manifest corollary that the season must vary in different individuals. A similarly brilliant coloration is occasionally found in *H. speoris* and some other species and in the smaller *Rhinolophi*. This was noticed as long ago as 1852 by Blyth.

167. **Hipposiderus amboinensis.** *The little leaf-nosed Bat.*

? Rhinolophus subbadius, *Hodgson, J. A. S. B.* xiii, p. 486, *nec Blyth.*
Phyllorhina amboinensis, *Peters, MB. Akad. Berl.* 1871, p. 323; *Dobson, Mon. As. Chir.* p. 72; *id. Cat. Chir. B. M.* p. 150; *Scully, J. A. S. B.* lvi, pt. 2, p. 249.
Phyllorhina micropus, *Hutton, P. Z. S.* 1872, p. 703.

Ears when laid forward not extending to the end of the muzzle. Size considerably smaller, and projecting extremity of tail longer. In other respects this species agrees with *H. bicolor*, to which it was united by Dobson.

Dimensions. Head and body 1·7 inches, tail 0·95, ear from crown 0·45, forearm 1·4.

Distribution. This bat has been found at Mussoorie and Katmandu in the Himalayas, and at Lingasugúr, N.N.W. of Bellary in the Deccan; also in Amboyna.

H. stoliczkanus (*Phyllorhina trifida*, Peters), a small species with the posterior nose-leaf very peculiarly formed, is found in Penang. Although the type of *P. trifida* was said to be from Burma (P. Z. S. 1871, p. 513), the form has not yet been obtained except at the original locality.

Genus **CŒLOPS**, Blyth (1848).

Nose-leaf well developed, consisting of three parts. Anterior leaf bifid, composed of two distinct lappets, one on each side, from

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beneath each of which a supplementary lappet extends forward over the muzzle. Sella transverse, as in *Hipposiderus*. Posterior leaf semicircular, the rounded posterior margin bent forward so as partly to conceal the front surface, and bearing a small heart-shaped, flat projection in the middle. Index finger extending beyond the end of the first phalanx of the middle finger. No tail. Calcaneum short and weak; interfemoral membrane deeply emarginate.

Dentition: i. $\frac{2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$, as in *Hipposiderus*. The upper incisor has a small additional cusp in front, and a large one behind, both some distance above the base. First upper premolar small, placed internally to the tooth-row. The teeth generally resemble those of *Hipposiderus*.

168. **Cœlops frithi.** *The tailless leaf-nosed Bat.*

Cœlops frithi, *Blyth, J. A. S. B.* xvii, p. 251 (1848); *id. Cat.* p. 27; *Jerdon, Mam.* p. 29; *Dobson, J. A. S. B.* xli, pt. 2, p. 141; *id. Mon. As. Chir.* p. 74; *id. Cat. Chir. B. M.* p. 152; *id. Rep. Brit. Assoc.* 1880, p. 180; *Anderson, Cat.* p. 119.

Ears rounded, the whole surface hairy, both margins convex, and the outer margin very much so, so as to form a large antitragal lobe, which, however, is not separated by any notch from the rest of the ear-conch. The supplementary lappets of the anterior nose-leaf come forward beyond the end of the muzzle. There are two or three tubercles on the nose-leaf close to the nostrils, which are much sunken. Sella very broad from front to back and with a raised rib in the middle. The sides of the nose-leaf covered with long hairs, as is the face generally. Behind the posterior leaf is a circular pore with a pencil of long hairs from it.

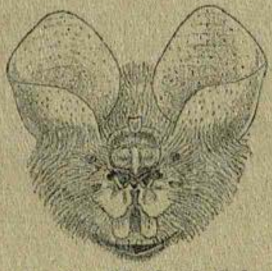

Fig. 88.—Head of *Cœlops frithi.* (Dobson, Cat. Chir. B. M.)

Metacarpal bone of thumb very long, phalanx short; the thumb included in the wing-membrane to the base of the claw. Wings from the metatarsus. The posterior border of the interfemoral membrane angularly emarginate as far as a line between the knees.

Colour dusky, the fur tipped with dull ashy brown above, paler and somewhat albescent below, according to Blyth, but Dobson says shining brown above and below, the bases of the hairs much paler. There is probably some variation.

Dimensions. Head and body 1·7 inches, depth of interfemoral membrane in middle 0·3, ear from crown 0·45, forearm 1·6, thumb without claw 0·3 (of which the metacarpal is 0·25).

Distribution. This was originally described from a Sundarban specimen, but has recently been discovered at Darjiling by Col. Kinloch. It has also been found in Siam and Java.

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Family NYCTERIDÆ.

A distinct nose-leaf around the nostrils, which are situated on the upper surface of the muzzle. Ears large, united at the base; tragus well developed. Middle finger with two phalanges, of which the first is extended in repose, in a line with the metacarpal bone; index finger with or without a phalanx besides the metacarpal; tibia long, fibula rudimentary or absent. Premaxillary bones cartilaginous or small; upper incisors small or absent; molars well developed.

The nasal appendages are much less complicated than in the *Rhinolophidæ*, but are well developed in the Indian forms belonging to the present family.

The *Nycteridæ* inhabit the Ethiopian, Oriental, and Australian regions. Two subfamilies, each containing a single genus, are recognized by Dobson, but only one of these occurs within Indian limits.

Genus **MEGADERMA**, Geoffr. (1810).

Muzzle long; nostrils in a depression near the extremity, surrounded by a naked expansion or nose-leaf, which extends to the end of the muzzle anteriorly and for some distance posteriorly between the eyes; the nostrils are covered and concealed by a second smaller flat leaf, resting upon the other; the lower lip, when viewed from above, is seen to project beyond the upper. Ears large, joined at the base; tragus long, bifid. No external tail. Wings ample; interfemoral membrane large, concave behind. Index finger with a single short bony phalanx besides the metacarpal bone; tibia very long; calcaneum distinct. A pair of pubic teat-like appendages as in the *Rhinolophidæ*.

Dentition: i. $\frac{0}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$, in both Indian species.

The upper canine has a pointed internal basal cusp, directed obliquely inwards, and resembling an incisor, also a large posterior cusp. The first upper premolar is exceedingly minute, and situated

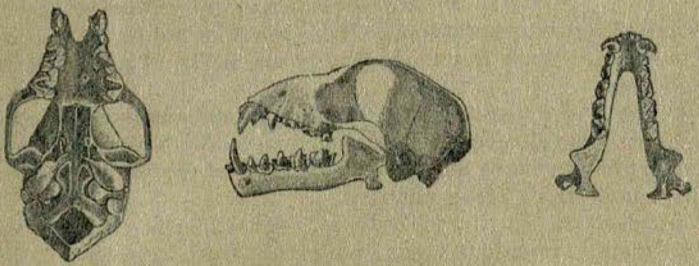

Fig. 89.—Skull of *Megaderma lyra*. (Dobson, Mon. As. Chir.)

quite inside the anterior lobe of the large second premolar; the last molar is scarcely half the size of either of the anterior molars. Lower incisors equal, tricuspid. The African forms want the first upper premolar entirely.

Species of *Megaderma* are found in Southern Asia, the Malay Archipelago, in Australia and in Africa. Two forms occur within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Posterior termination of nose-leaf truncated. . . . *M. lyra*, p. 293.
B. Posterior termination of nose-leaf rounded . . . . *M. spasma*, p. 294.

169. **Megaderma lyra.** *The Indian Vampire Bat.*

Megaderma lyra, *Geoffr. Ann. Mus.* xv, p. 190 (1810); *Blyth, J. A. S. B.* xi, p. 255, xiii, p. 480, xx, p. 156; *id. Cat.* p. 22; *Kelaart, Prod.* p. 11; *Jerdon, Mam.* p. 22; *Dobson, P. A. S. B.* 1872, p. 208; *id. Mon. As. Chir.* p. 78; *id. Cat. Chir. B. M.* p. 156; *Anderson, Cat.* p. 120.
Vespertilio (Megaderma) carnatica, *Elliot, Mad. Jour. L. S.* x, p. 96.
Megaderma spectrum, *Wagner, Hügel's Kaschmir*, iv, p. 569, pl.; *Jerdon, Mam.* p. 22.
Megaderma schistacea, *Hodgson, J. A. S. B.* xvi, p. 889, pl. xxxix.

Ears very large, extending, when laid forward, considerably beyond the muzzle, their inner margins united for more than one third the length; their tips broadly rounded off, margins convex, outer margins terminating halfway between the tragus and the angle of the mouth. Tragus very large, bifid, the posterior portion long and pointed, the anterior portion about half the length of the posterior, rounded on its anterior margin and above.

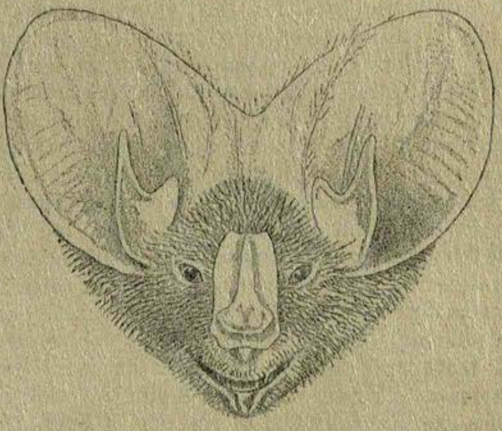

Fig. 90.—Head of *Megaderma lyra*. (Copied from Dobson, Cat. Chir. B. M.)

Nose-leaf rounded in front, not varying much in breadth, but with a notch on each side behind the nostrils, dividing it into an anterior and posterior portion, the latter much the longer, having

GSL

the sides slightly convex and the posterior termination cut off squarely. The additional leaf that covers the nostrils is rounded below and joined to a prominent rib that traverses the posterior leaf from end to end, a deep groove corresponding to it on the lower surface. Lower lip with a projecting triangular naked extremity, divided by a deep median groove.

Wing-membranes from the back of the foot, at the base of the two outer toes. Fur soft and moderately long.

Colour of fur dark ashy or slaty grey above, paler, sometimes whitish, below.

Dimensions. Head and body 3·4 inches, ear from crown 1·1 (from origin of outer margin 1·6), forearm 2·6.

Distribution. India generally from Kashmir to Cape Comorin, and Ceylon; occurring west as far as Karáchi, and east to Calcutta and Mymensingh. This species is also found in China (Amoy, see Swinhoe, P. Z. S. 1870, p. 616; and Swatow, whence there is a skin in the British Museum). Hitherto, however, this bat has not been recorded from Burma. Col. McMaster notices the destruction of two canaries by bats in Rangoon, and suggests this species as the depredator, which is not improbable.

Habits. During the day this bat hides in caves, old buildings, roofs of houses, &c. The food may consist partly of insects; but it is certain that *Megaderma lyra* feeds on smaller bats, for one was detected and observed in the act by Blyth, and it probably lives chiefly on small Vertebrata. Mr. Frith informed Blyth that at Mymensing the verandah of his house was a favourite resort of a number of these bats, and that every morning the floor was strewn with the hind quarters of frogs and the wings of large grasshoppers and crickets; on one occasion the remains of a small fish were observed, but frogs appeared to constitute the bats' chief diet, never toads; and of a quiet evening these animals could be heard crunching the heads and smaller bones of their victims.

In the case observed by Blyth of a *Megaderma* killing and eating a smaller bat (*Vesperugo abramus*), the former began by seizing its prey behind the ear and sucking the blood during flight. Dobson shows that the peculiar dentition and lips of *Megaderma* are evidence of its prey differing from that of other insectivorous bats.

Hodgson has observed that in this species males greatly exceed females in number. Anderson found the young adhering to the abdominal teats and moving about from them to the true or pectoral mammæ. Hodgson found a single young in many pregnant females examined by him at the end of February.

170. **Megaderma spasma.** *The Malay Vampire Bat.*

Vespertilio spasma, *L. Syst. Nat.* i, p. 47 (1766).
Megaderma spasma, *Cantor, J. A. S. B.* xv, p. 179; *Blyth, J. A. S. B.* xxi, p. 346, xxiv, p. 711; *id. Cat.* p. 23; *Dobson, Mon. As. Chir.* p. 79; *id. Cat. Chir. B. M.* p. 157; *Anderson, Cat.* p. 121; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 264.
Megaderma horsfieldi, *Blyth, Cat.* p. 23.

Rather smaller than *M. lyra*, and nose-leaf shorter.

Ears rounded, extending beyond the muzzle when laid forward; inner margins united by less than a third of their length. Tragus bifid, the posterior limb pointed, more than double the length of the rounded anterior limb.

Nose-leaf rounded posteriorly, the lanceolate portion behind the lateral emarginations about equal in length to the anterior portion. The additional leaf above the nostrils heart-shaped and broad, projecting laterally beyond the edge of the principal leaf. A raised median rib to the posterior rib.

Wing-membrane from the metatarsus. Interfemoral membrane deeper than in *M. lyra*. In other characters the two species are similar.

Colour of fur dark ashy above, paler below.

Dimensions. Head and body 3·4 inches, ear from crown 1·2, from origin of outer margin 1·5, forearm 2·3.

Distribution. Tenasserim, Siam, Cochin China, and the Malay Peninsula and Archipelago; also Ceylon, and probably Travancore. A description by Mr. Bourdillon of a bat obtained by him at Mynall, Travancore, from a hollow tree in dense forest at 2700 feet elevation, appears to refer to this species, and this serves to confirm the statement by Blyth that he had examined specimens from Ceylon. There are specimens in the British Museum labelled from the island. They are rather small, forearm 2·1 to 2·2 inches.

Of the other genus belonging to the present family, *Nycteris*, having the nostrils at the anterior extremity of a long facial groove, and a long tail, one species, *N. javanica*, has been found in the Malay Peninsula and Java, the remaining species are all African.

Family VESPERTILIONIDÆ.

This is by far the largest family of bats and comprises most of the commoner forms found in India. The species are at once and readily distinguished from all other *Microchiroptera* (so far at least as the Indian and Palæarctic forms are concerned) by the presence of a tragus, by the absence of all trace of nose-leaf, by the tail neither being produced to any great extent beyond the interfemoral membrane, nor exserted from its upper surface, and by the presence of two phalanges besides the metacarpal bone, making three joints altogether, in the middle finger, with the first phalanx in repose extended in a line with the metacarpal bone. The eyes are minute, and the inner margins of the ears arise from the sides of the head, not from the forehead. The tail is long.

The lower incisors are always six in number; the upper incisors vary from 2 to 4, divided by a wide space in the middle, and placed in pairs or singly near the canine. The upper premolars vary from one to three in number on each side; when more than one occur, the anterior premolars are generally very small, and sometimes have a position inside the general line of the teeth, or tooth-row. The lower premolars are 2 or 3 on each side.

Members of this family are found throughout the tropical and temperate regions of the world, extending even to many oceanic islands.

Whilst the majority of the genera are well defined and easily recognized, the two great groups comprised in *Vesperugo* and *Vespertilio* contain several intermediate forms, so that although most of the species fall readily into two perfectly distinct genera, the actual line of distinction is artificial and depends on the presence or absence of an upper premolar *, which is, in some cases, not to be detected without the aid of a lens. The genera found in India may be thus distinguished:—

A. Crown of head but little raised above face-line; second or terminal phalanx of third or longest finger not more than double length of first phalanx.
  a. Ears distinctly united at base.
    a′. Ears enormous, outer margin of each terminating behind angle of mouth . . . . . . PLECOTUS.
    b′. Ears moderate, outer margin carried forward and terminating above mouth . . . . SYNOTUS.
  b. Ears not united at base.
    a′. Ears very large, about double length of head . . . . OTONYCTERIS.
    b′. Ears moderate, about same length as head or less.
      a″. Outer margin of ear-conch terminating about halfway between tragus and angle of mouth; 4 or 5 teeth behind canine on each side of upper jaw.
        a‴. Two pairs of upper incisors . . . . . . VESPERUGO.
        b‴. Only one pair of upper incisors; one on each side, close to canine . . . . NYCTICEJUS.
      b″. Outer margin of ear terminating nearer to tragus than to angle of mouth.
        a‴. Nostrils tubular, projecting; 5 teeth behind canine on each side of upper jaw . . . . HARPYIOCEPHALUS.
        b‴. Nostrils simple; 6 teeth in upper molar row.
          α. Nostrils crescentic . . . . VESPERTILIO.
          β. Nostrils rounded. . . . . CERIVOULA.

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* In specimens preserved in spirit the mouth can be opened widely and the teeth examined with a microscope if necessary. With bats, however, as with other small mammals, it is well to extract and clean one or two skulls of each species.

B. Crown of head greatly raised above face-line; outer margin of ear terminating close to angle of mouth; second or terminal phalanx of third or longest finger more than treble the length of first phalanx .... MINIOPTERUS.

Genus **PLECOTUS**, Geoffr. (1813).

Ears very large, the inner margins united, outer margin of each terminating just behind the angle of the mouth; tragus large, tapering. Nostrils elongate, narrow, crescentic, situated at the extremity of the muzzle, the upper surface of which is hairy, flat and depressed in the middle, but swollen at the sides, which bulge above the central depression, and sometimes cover it just behind the nostrils. Muzzle not grooved in front below the nostrils.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{3-3}$, m. $\frac{3-3}{3-3}$. Upper incisors widely separated in the middle and directed obliquely inwards, the inner are bifid, the inner cusp of each considerably longer than the outer, and this again is larger and longer than the small simple unicuspidate outer incisor; canines without accessory cusps; first upper premolar small, but distinctly seen from the outside, second premolar large. Of the lower premolars the third is the largest and the second the smallest.

The only Palæarctic species, which has an extensive range, is found in the Himalayas.

171. **Plecotus auritus.** *The long-eared Bat.*

Vespertilio auritus, *L. Syst. Nat.* i, p. 47 (1766).
Plecotus homochrous, *Hodgson, J. A. S. B.* xvi, p. 895.
Plecotus auritus, *Blyth, Cat.* p. 35; *Jerdon, Mam.* p. 47; *Hutton, P. Z. S.* 1872, p. 704; *Dobson, Mon. As. Chir.* p. 84; *id. Cat. Chir. B. M.* p. 178; *Anderson, Cat.* p. 123; *Scully, P. Z. S.* 1881, p. 199.

Ears enormous, not much shorter than the head and body together, ovate, the tips broadly rounded. Inner margins joined near the base, just above the junction a prominent rounded lobe projects from each.

Wings from the base of the toes; feet slender. Tail as long as the head and body; the tip exserted. Fur soft.

Colour brown, generally fawn-colour or light brown above, whitish below. The basal half or two-thirds of the fur, above and below, is nearly black. Some specimens are dark throughout, owing to the wearing away of the paler tips to the hairs; such a specimen is the type of Hodgson's *P. homochrous.*

Dimensions of a female from near Mussoorie: head and body 1·7 inches, tail 1·7, ear from crown 1·35, tragus (inner margin)

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0·7, forearm 1·65 (Hutton's measurements of, I believe, this individual when fresh are larger; head and body $2\frac{1}{4}$, &c.).

Distribution. The Palæarctic region, including the higher portions of the Himalayas from Gilgit (Scully) and Leh (Stoliczka) to Darjiling. The Himalayan variety has rather longer ears than the European, but the short thumb, observed by Dobson in Hodgson's type of *P. homochrous*, appears to be an individual peculiarity, as it does not exist in other Himalayan specimens.

Habits. The long-eared bat, according to Blasius, hides in hollow trees or old buildings (probably in caves also) during the day and comes out rather late in the evening. The flight is not rapid, but the twists and turns are quickly made. This species only flies in the summer months, hibernating in the winter. The ears are usually folded under the arms during sleep.

Genus **SYNOTUS**, Keys. & Blas. (1839).

Syn. *Barbastellus*, Gray, 1838 (*nec* 1831).

Ears of moderate size, the inner margins coming forward at the forehead rather in front of the eyes and united at the base; the outer margin of each ear carried forward below the eye and terminating between the eye and upper lip; thus the eye, which is minute, is within the external ear; tragus well developed, attenuate above.

Muzzle short, the upper surface naked and flat in the middle, the sides glandular and swollen so as to form a raised border, the nostrils at the end of the muzzle, a broad shallow groove from each across the upper lip.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Upper incisors oblique, outer pair small, inner pair large and bifid; upper canines with small anterior and posterior basal cusps. First upper premolar minute, in the inner angle between the closely approximate canine and second premolar. First lower premolar half the height and breadth of the second.

This genus comprises two known species, both Palæarctic; one of them is found in the Himalayas.

172. **Synotus darjelingensis.** *The Eastern Barbastelle.*

Plecotus darjelingensis, *Hodgson, Horsfield, A. M. N. H.* (2) xvi, p. 103 (1855).

Barbastellus communis, *Blyth, J. A. S. B.* xxi, p. 360, xxiv, p. 363; *id. Cat.* p. 36; *Jerdon, Mam.* p. 48; *Hutton, P. Z. S.* 1872, p. 703; *Dobson, J. A. S. B.* xliii, pt. 2, p. 236, *nec Gray.*

Barbastellus dargelinensis, *Dobson, P. A. S. B.* 1875, p. 85.

Synotus darjelingensis, *Dobson, Mon. As. Chir.* p. 86; *id. Cat. Chir. B. M.* p. 177; *Anderson, Cat.* p. 123; *Scully, P. Z. S.* 1881, p. 199.

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The ears are very broad and, when laid forward, extend beyond the nostrils, tips broadly rounded, inner margin convex, outer almost straight for nearly half its length, and without any projecting lobe, lower half also nearly straight. Tragus broad at the base, and becoming broader just above the commencement of the inner margin, but attenuate thence to the narrow but rounded tip.

Wings from the base of the toes. Calcaneum extending halfway from the foot to the end of the tail. Postcalcaneal lobe narrow. Tail as long as the head and body; tip projecting from interfemoral membrane, which extends triangularly far behind the feet. Fur soft and long.

Colour greyish black, the hairs with paler greyish tips, more conspicuous below than above.

Dimensions. Head and body 2 inches, tail 1·9, ear from crown 0·45, forearm 1·65.

Distribution. This form, which is distinguished from the European *Synotus barbastellus* by larger ears without any projecting lobe to the outer margin, appears to be common in the Himalayas at an elevation of 5000–8000 feet, and has been taken at Gilgit, Simla, Mussoorie, and Darjiling, in Upper Sikhim at Lachung, and also in the Khási hills south of Assam. The same bat was also procured by Stoliczka in Eastern Turkestan, and may very possibly replace *S. barbastellus* in Central and Eastern Asia.

Habits. According to Hutton the Eastern barbastelle makes its appearance rather late in the evening. It hibernates in winter. He remarks on the very narrow holes and crevices into which it squeezes itself. The European form is said to appear in the evening before *Plecotus auritus* and to fly higher and more rapidly *.

Genus **OTONYCTERIS**, Peters (1859).

Head very flat; nostrils crescentic, at the extremity of the muzzle. Ears large, separate †; tragus long.

Dentition: i. $\frac{1-1}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{1-1}{2-2}$, m. $\frac{3-3}{3-3}$. The upper incisors close to the canines and bifid, the outer cusps very small; single upper premolar large, close to the canine; lower incisors flattened laterally, the longer diameter of each transverse to the line of teeth; first lower premolar scarcely half the size of the second.

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* An Australian bat, *Nyctophilus geoffroyi* (*N. timoriensis*, see Dobson, Cat. Chir. B. M. p. 172), was by mistake included by Jerdon (Mam. Ind. p. 48) amongst Indian forms and stated to have been sent from Mussoorie by Hutton, who, however (P. Z. S. 1872, p. 704), denied all knowledge of the species. It is evident that the error, which has puzzled some writers on the Indian Mammalia, arose from a mistake in the printing of Blyth's Catalogue (see J. A. S. B. lvii, pt. 2, p. 264).

† According to Dobson, there is, hidden amongst the hairs of the forehead, a very low band that connects the ears, but practically they are separated.

Of this genus, which is evidently allied to *Plecotus*, only one species is known.

173. **Otonycteris hemprichi.** *Hemprich's long-eared Bat.*

Otonycteris hemprichii, *Peters, MB. Akad. Berl.* 1859, p. 223; *Dobson, Cat. Chir. B. M.* p. 182; *Scully, P. Z. S.* 1881, p. 199.

Ears large, very much longer than the head, oval, broadly rounded at the tips, inner margin convex, lower third especially so, but without any projection, outer margin nearly straight for the upper half, then convex, emarginate opposite the base of the tragus, terminating behind the angle of the mouth. Tragus long, attenuate, rounded at the end.

Wings from the base of the toes. Tail long, the point beyond the triangular extremity of the interfemoral membrane. No post-calcaneal lobe. Fur long, dense, and soft.

Colour above pale sepia-brown, all the basal portions of the hairs white, below white; membranes and ears pale brown.

Dimensions. Head and body 3 inches, tail 2·3, ear from crown 1·25, forearm 2·6.

Distribution. Two specimens have been obtained in Gilgit, one by Col. Biddulph, the other by Dr. Scully. The type was brought by Hemprich and Ehrenberg from N.E. Africa, and a specimen has recently been recorded from Algeria.

Genus **VESPERUGO**, Keys. & Blas. (1840).

Syn. *Noctulinia*, Gray (1842); *Scotophilus*, partim, Gray, *nec* Leach; *Myotis*, partim, Blyth, *nec* Gray.

Ears separate, moderate or short, generally much shorter than the head, each outer margin terminating behind the angle of the mouth and considerably in front of the base of the tragus; the terminal portion of the outer margin usually consists of a

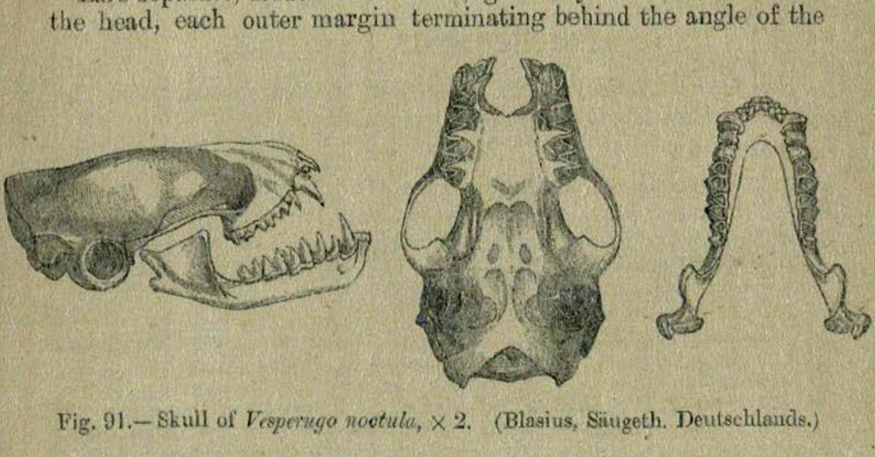

Fig. 91.—Skull of *Vesperugo noctula*, × 2. (Blasius, Säugeth. Deutschlands.)

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rounded lobe or antitragus, the inner margin is turned inwards near the base and generally forms a rounded edge termed the basal lobe. Tragus generally short and obtuse, the outer margin more or less convex, the inner straight or concave.

Muzzle in most species short and obtuse *, with prominent glandular swellings at the side between the eyes and nostrils, increasing the width of the face; the sides of the head as far back as the ears, and extending upwards to above the eyes, together with the terminal portion of the muzzle above from a little in front of the eyes, are very thinly covered with hair. Tail shorter than the head and body together; there is a small membranous expansion (the postcalcaneal lobe), varying much in form and development, behind the calcaneum, and the interfemoral membrane always ends posteriorly in a salient angle. Wings (except in *V. noctula*, *V. leisleri*, and two Malayan species) from the base of the toes.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$ or $\frac{1-1}{2-2}$, m. $\frac{3-3}{3-3}$. The upper incisors in pairs inclined inwards and separated by a wide interval in the middle, outer incisor of each pair close to the inner and parallel to it; the inner generally the larger of the two and often bifid, the outer sometimes very small (see fig. 92, p. 306). First upper premolar minute or wanting, often, when present, difficult to detect. First lower premolar in the tooth-row, not crushed in between the adjoining teeth; its summit directed slightly outwards.

This genus of bats, which comprises more species than any other, and contains the commonest and most widely spread forms, is found in all extensive land areas, except those of the polar regions, but is particularly well represented in the temperate and subtropical portions of the Eastern hemisphere. All the species have a rapid flight with very sudden twists and turns, and many are amongst the first bats to appear in the evening and the earliest to leave their winter-quarters in the spring. In the majority of the species, according to Blasius, unlike other bats, the females produce two young at a time; but Dobson found one to be the rule in the numerous specimens that he examined.

On account of the number of species included, attempts have been made to divide the genus, but the subgenera, with the exception of *Hesperoptenus*, are ill defined and more or less artificial. This is especially the case with the two largest subgenera, *Vesperus* and *Vesperugo*. The small first upper premolar, wanting in the first but present in the latter, is sometimes to be distinguished from outside between the canine and the second premolar, but often it can only be detected by the use of a good lens when the mouth is widely opened.

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* *V. annectens* differs in this and several other characters.

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Synopsis of Indian, Ceylonese, and Burmese Species of Vesperugo.

A. Incisors $\frac{2-2}{6}$; outer upper incisors in a line with inner or anterior to them; premolars $\frac{1-1}{2-2}$ (four teeth behind canine in the upper jaw); wings from base of toes .... Subgenus VESPERUS.
  - *a.* No thickened base to ear, nor swollen pads to feet.
    - *a'*. Forearm 2 inches or more long ...... *V. serotinus*, p. 303.
    - Forearm less than 2 inches.
      - *a''*. No postcalcaneal lobe; forearm 1·45. *V. nasutus*, p. 304.
      - *b''*. Postcalcaneal lobe present.
        - *a*. Ears much shorter than head.
          - *a'*. Tragus broadest below middle of inner margin; forearm 1·5 .... *V. borealis*, p. 305.
          - *β'*. Tragus broadest above middle of inner margin; forearm 1·6. ... *V. discolor*, p. 305.
        - *β*. Ears nearly as long as head; forearm 1·7 .... *V. atratus*, p. 306.
  - *b.* Base of ear thickened; forearm 1·6 ...... *V. pachyotis*, p. 307.
  - *c.* Soles of feet and base of thumbs with broad fleshy pads; forearm 1·1 .... *V. pachypus*, p. 307.

B. Incisors $\frac{2-2}{6}$, outer upper incisors in same line as inner, or anterior to them; premolars $\frac{2-2}{2-2}$ (five teeth in upper jaw behind canine), first upper premolar minute ..... Subgenus VESPERUGO.
  - *a.* Wings from ankles.
    - *a'*. Forearm 2 inches or more.......... *V. noctula*, p. 308.
    - *b'*. Forearm about 1·65 .... *V. leisleri*, p. 309.
  - *b.* Wings from base of toes.
    - *a'*. Tragus rounded above.
      - *a''*. Tragus broadest about middle of inner margin.
        - *a*. Fur above black.
          - *a'*. Outer upper incisors but little shorter than inner; a postcalcaneal lobe; forearm 1·55 .... *V. mordax*, p. 310.
          - *β'*. Outer upper incisors very short; no postcalcaneal lobe; forearm 1·5........................ *V. circumdatus*, p. 312.
        - *β*. Fur above brown.
          - *a'*. Outer upper incisors acutely pointed; forearm 1·55........ *V. affinis*, p. 311.
          - *β'*. Outer upper incisors hollowed to receive lower canines; forearm 1·65 .... *V. ceylonicus*, p. 312.
      - *b''*. Tragus broadest slightly above base of inner margin.
        - *a*. Outer upper incisors more than half length of inner.
          - *a'*. Outer margin of ear below tip straight; forearm 1·3 .... *V. abramus*, p. 313.
          - *β'*. Outer margin of ear below tip concave; forearm 1·25 ...... *V. pipistrellus*, p. 314.

GSL

β. Outer upper incisors less than half length of inner; interfemoral membrane white-edged; forearm 1·4. . *V. kuhli*, p. 315.
b′. Tragus pointed above; face hairy; forearm 1·8. . . . . *V. annectens*, p. 316.
C. Incisors $\frac{2-2}{6}$, outer upper incisors very small, behind inner incisors; pm. $\frac{1-1}{2-2}$; wings from base of toes. . . . . Subgenus HESPEROPTENUS.
a. Forearm 2·1 inches. . . . . *V. tickelli*, p. 317.
b. Forearm 1·1. . . . . *V. blanfordi*, p. 317.

174. Vesperugo serotinus. *The Serotine.*

Vespertilio serotinus, *Schreb. Säugeth.* i, p. 167, pl. 53 (1775).
Scotophilus serotinus, *Blyth, J. A. S. B.* xxi, p. 360; *id. Cat.* p. 32; *Jerdon, Mam.* p. 34.
Scotophilus pachyomus, *Tomes, P. Z. S.* 1857, p. 50; *Jerdon, Mam.* p. 34.
Vesperugo andersoni, *Dobson, P. A. S. B.* 1871, p. 211; *id. Mon. As. Chir.* p. 110; *id. Cat. Chir. B. M.* p. 195; *id. Rep. Brit. Assoc.* 1880, p. 184; *Anderson, An. Zool. Res.* p. 101, pl. iv, figs. 2–6; *id. Cat.* p. 124.
Vesperugo serotinus, *Dobson, Mon. As. Chir.* p. 108; *id. Cat. Chir. B. M.* p. 191; *id. Second Yarkand Miss., Mam.* p. 12; *Anderson, Cat.* p. 124.

Ears of moderate size, the broadly rounded tips, when laid forward along the face, are rather nearer to the nostril than to the eye; inner margin slightly convex, basal lobe rounded, outer margin straight or very slightly concave for its upper half, then convex, slightly emarginate opposite the base of the tragus and ending in a convex lobe behind the angle of the mouth. Tragus broadest just above the base of the inner margin, thence diminishing slowly in breadth to the tip, which is rounded, inner margin straight or slightly concave, outer convex with a small projecting rounded lobe at the base.

Head flat. Muzzle flat and thick, the sides swollen and glandular; face almost naked in front, but the upper lip fringed with hair. Thumb with a callosity at the base. Wings from the metatarsus close to the base of the toes. Postcalcaneal lobe very narrow. Last two caudal vertebræ free.

Upper inner incisors long, strong, bifid at their extremities, when not worn down; outer incisors very short, scarcely one third the length of the inner pair, and lying against their outer and anterior sides. Lower incisors trifid, crowded. First lower premolar half the breadth and half the height of the second.

V. andersoni, with smaller and narrower ears, a rather smaller foot, only the last caudal vertebra free, and some other slight differences, was ultimately classed by its describer as a variety of the Serotine.

Colour. Above dark smoky brown as a rule, below yellowish brown to yellowish white. Specimens from dry desert countries are pale buff-brown above, paler beneath.

Dimensions of a male from Kashmir. Head and body 2·85 inches, tail 2, ear from crown 0·5, forearm 2·1.

Distribution. Palæarctic and Nearctic regions, with parts of the Neotropical and Oriental. This bat seems to be common in Kashmir, and was found in Assam by Col. Godwin-Austen. Blyth, too, identified it amongst the bats obtained near Mussoorie by Hutton. The variety *V. andersoni* was obtained in Yunnan.

Habits. The name of this bat indicates one of its characteristic traits, that of appearing late in the evening. It likewise does not come out of its winter sleep until the spring is well advanced. According to Blasius it does not fly about on cold, wet, and windy nights, but it is to be seen, in Europe, on warm summer evenings about woods and gardens. It is frequently found in hollow trees in the day, and remains as a rule solitary or in small numbers even in winter. Its flight is rather slow and the action of its wings fluttering; its turns are less actively made than those of its allies of the genus *Vesperugo* generally. As a rule it has only one young at a time.

175. **Vesperugo nasutus.** *The Sind Bat.*

Vesperugo nasutus, *Dobson, J. A. S. B.* xlvi, pt. 2, p. 311 (1877); *id. Cat. Chir. B. M.* p. 200; *Anderson, Cat.* p. 125.

Ears shorter than the head, triangular, the tips rounded; inner margin of each commencing above the eye, not forming a distinct rounded lobe at the base, but straight almost from the base to the tip of the ear, outer margin also straight. Tragus broadest below the middle of the inner margin, the outer margin convex with an ill-defined lobe near the base, inner margin slightly concave, tip subacutely pointed.

Head flat, muzzle conical, the extremity projecting considerably beyond the lower lip in front, nostrils opening sublaterally. No postcalcaneal lobe. Only the tip of the tail is free. Fur short, the face nearly naked in front of the eyes.

Upper inner incisors moderately long and unicuspidate, outer pair very short; lower incisors trifid, crowded, longest across the direction of the jaws. First lower premolar not half as long as the second.

Colour above pale yellowish brown; beneath pale buff, almost white; membranes light brown, traversed by numerous white reticulations.

Dimensions. Head and body 1·8 inches, tail 1·7, ear (from base of outer margin) 0·6, forearm 1·45.

Distribution. The only specimen known was obtained by myself in Upper Sind. I believe that the type of the present species was procured a little east of Rohri. The locality originally assigned, Shikárpur, was that of some other specimens in the same collection.

The above description is taken from that by Dobson.

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176. **Vesperugo borealis.** *The Northern Bat.*

Vespertilio borealis, *Nilsson, Illum. Fig. Scand. Fauna*, häft. 19, pl. 36 (1838).
Vesperugo nilssoni, *Keys. & Blas. Wiegm. Arch.* 1839, p. 315.
Vesperugo borealis, *Dobson, Mon. As. Chir.* p. 105; *id. Cat. Chir. B. M.* p. 203; *Scully, P. Z. S.* 1881, p. 200.

Ears nearly triangular, tips broadly rounded, outer margin straight almost to the base, where it turns forwards and after a distinct emargination terminates in a short but prominent lobe, just behind the angle of the mouth. Inner margin straight above, ending below in a rounded basal lobe. Outer margin of tragus very convex with a projecting lobe at the base, inner margin straight below and slightly concave above, tip rounded, greatest breadth below the middle of the inner margin.

Muzzle flat and of moderate breadth. Postcalcaneal lobe distinct, but narrow; the two last caudal vertebræ free.

The inner upper incisor bifid, outer incisor as long as the outer and shorter cusp of the inner incisor, and equal to the latter in cross section at the base; lower incisors trifid, placed at right angles to the jaw, and overlapping each other, those next the canines rounded above and higher than the rest.

Colour of fur very dark brown, above with yellowish-brown tips, below with ashy.

Dimensions. Head and body 2 inches, tail 1·7, ear from crown 0·4, forearm 1·5.

Distribution. Throughout the northern Palæarctic region, as far north as the Arctic Circle. This species has been obtained in Eastern Turkestan and China. The only specimen hitherto recorded within Indian limits was taken by Dr. Scully in Gilgit.

Habits. According to Blasius this species, which flies well and quickly, migrates north in summer, being only found in Northern Russia about August, and is, of all European bats, the least sensitive to cold and bad weather. According to the same authority, the female usually produces two young at a time.

177. **Vesperugo discolor.** *The particoloured Bat.*

Vespertilio discolor, *Natterer, Kuhl, Deutsche Flederm.* p. 43 (1817); *id. Wetterau Gesell. N. Annal.* i, p. 187 (1819).
Vesperugo discolor, *Dobson, Mon. As. Chir.* p. 106; *id. Cat. Chir. B. M.* p. 204; *Anderson, Cat.* p. 125; *Scully, P. Z. S.* 1881, p. 199.

Ears oval, tips broadly rounded; outer margin straight for the upper third, folded back on itself about the middle, emarginate opposite the base of the tragus, and terminating in a long, but not prominent lobe behind and a little above the angle of the mouth, a tubercle between the termination and the angle; inner margin very slightly convex above, more so below, and with a prominent rounded basal lobe. Outer margin of tragus with a small projecting basal lobe, above very convex, tip rounded, inner

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margin straight, broadest portion of tragus just above the middle of the inner margin.

Muzzle broad, flat above, end of the nose and upper lip projecting slightly beyond the lower; postcalcaneal lobe narrow Last caudal vertebra and part of penultimate free.

Inner upper incisor long, bifid; the outer incisor is shorter than the outer and shorter cusp of the inner incisor. First lower premolar about half the height of the second.

Colour of the fur above dark brown with pale yellowish-brown tips, below dark brown with ashy or whitish tips longer than those on the back, the dark basal part of the hairs producing a somewhat mottled appearance on the dorsal surface.

Dimensions. Head and body 2 inches, tail 1·65, ear from crown 0·4, forearm 1·6.

Distribution. The Palæarctic region throughout the temperate zone, keeping much to hills and mountains. Within Indian limits this species has been recorded only at Gilgit, where a few were found in summer at from 10,000 to 11,000 feet above the sea by Dr. Scully.

Habits. Very similar to those of the nearly allied *V. borealis.* The flight is rather stronger, but the animal is more sensitive to cold, and its range does not extend nearly so far to the north. The female is said by Blasius always to produce two young at a time.

178. **Vesperugo atratus.** *The sombre Bat.*

Nycticejus atratus, *Blyth, Cat.* p. 31 (no description); *Jerdon, Mam.* p. 38 (1867).
Vesperus atratus, *Dobson, P. A. S. B.* 1871, p. 212.
Vesperugo atratus, *Dobson, Mon. As. Chir.* p. 107; *id. Cat. Chir. B. M.* p. 206; *Anderson, Cat.* p. 125.

Ears oval, tips rounded, but appearing pointed when viewed from the side, owing to the conch being longitudinally folded, like in *Cerivoula*; inner margin convex, outer slightly hollowed beneath the tip, with an angular emargination opposite the base of the tragus, and terminating in a rounded lobe, the summit of which is marked by a small triangular notch. Tragus with a small rounded lobe at the outer side of its base, expanded above, convex externally and above, inner margin slightly concave.

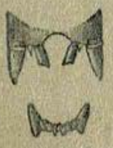

Fig. 92.—Incisors and canines of *V. atratus.* (Dobson, Mon. As. Chir.)

Wings from the base of the toes; last rudimentary caudal vertebra free. Fur long and dense.

Inner upper incisors very long and slightly bifid at the extremity; outer incisors minute, scarcely raised above the level of the gum and close to the base of the inner incisors.

Colour black throughout.

Dimensions. Head and body 1·9 inches, tail 1·8, ear (from base of outer margin) 0·6, forearm 1·7.

Distribution. Only recorded hitherto from Darjiling. The ription is taken from Dobson's.

179. **Vesperugo pachyotis.** *The thick-eared Bat.*

Vesperugo pachyotis, *Dobson, P. A. S. B.* 1871, p. 211; *id. Mon. As. Chir.* p. 104; *id. Cat. Chir. B. M.* p. 206; *Anderson, Cat.* p. 126.

"Ears triangular above, with rounded tips; outer side straight without emargination; lower portion of the ear (from below the level of the tip of the tragus to the termination of the outer margin near the angle of the mouth) very thick and fleshy; tragus short, expanded above and curved inwards.

"Head flat, muzzle very broad and short, glandular prominences much developed; immediately behind them a furrow extends from the anterior corner of one eye to that of the other, beyond which the fur of the head does not pass." "Wing-membrane from the base of the toes. Teeth very small; inner incisors bifid at their extremities, much larger and longer than the outer."

Colour above dark brown throughout, below a lighter shade of brown.

Dimensions. Head and body 2·2 inches, tail 1·6, ear (from base of outer margin) 0·55, forearm 1·6.

Distribution. Only found hitherto in the Khási hills, south of Assam. The types, a male and female, in the Indian Museum, Calcutta, are the only specimens hitherto recorded.

The above description is copied from Dobson, who remarks that the species, which may be recognized by the peculiar thickness of the lower half of the ear-conch, is rather related in the form of the ears and muzzle to *V. noctula* and its allies, but that the first minute upper premolar, characteristic of those forms, is wanting.

180. **Vesperugo pachypus.** *The club-footed Bat.*

Vespertilio pachypus, *Temminck, Mon. Mamm.* ii, p. 217, pl. 54, figs. 4–6 (1835–41).
Scotophilus fulvidus, *Blyth, J. A. S. B.* xxviii, p. 293 (1859); *id. Cat.* p. 33.
Vesperus pachypus, *Dobson, P. A. S. B.* 1871, p. 212.
Tylonycteris pachypus, *Peters, MB. Akad. Berl.* 1872, p. 704; *Blyth, Mam. Birds Burma*, p. 23.
Vesperugo pachypus, *Dobson, Mon. As. Chir.* p. 115; *id. Cat. Chir. B. M.* p. 208; *Anderson, Cat.* p. 126; *Thomas, P. Z. S.* 1886, p. 59.

Ears short, scarcely extending to halfway between the eye and nostril when laid forward, oval, with broadly rounded tips; outer margin slightly convex, with a shallow but distinct emargination below the base of the tragus, and terminating in a convex lobe behind the angle of the mouth; inner margin straight in the middle, convex above, and with a well rounded basal lobe. Tragus short, widest opposite the base of the inner margin, which is nearly straight, tip rounded, outer margin convex and having a small lobe at the base.

Crown of head very flat, muzzle broad, nostrils directed somewhat

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downwards. The under surface of the base of the thumbs and the soles of the feet expanded into fleshy pads. In some specimens the thumb-pad extends almost to the base of the claw. On the foot the pad forms an almost circular disk, the round margin projecting a little beneath the toes, which are short. Wings rather short; calcaneum short and feeble; postcalcaneal lobe rudimentary. Only the extreme tip of the tail projects from the interfemoral membrane.

Upper incisors all small, the inner bicuspid, the outer anteriorly placed and shorter than the smaller outer cusp of the inner; lower incisors not crowded.

Colour of fur moderately deep rich brown, with a rufous tinge above, paler below; dorsal hair a little paler towards the base.

Dimensions. A female from Darjiling measures:—head and body 1·5 inches, tail 1·05, ear from crown 0·25, forearm 1·05. Dobson gives rather larger measurements:—head and body 1·75, tail 1·3, forearm 1·1.

Distribution. Eastern Himalayas (Darjiling), Manipur, Tenasserim, Mergui Archipelago, Andaman Islands, and probably the Burmese and Malay countries generally, extending to Java, Sumatra, and the Philippine Islands.

The fleshy foot- and thumb-pads are supposed by Dobson to be adapted for adhering to the under surface of large leaves and fruits.

181. **Vesperugo noctula.** *The noctule Bat.*

Vespertilio noctula, *Schreb. Säugeth.* i, p. 166, pl. 52 (1775).
Vesperugo labiata, *Hodgson, J. A. S. B.* iv, p. 700 (1835).
Noctulinia noctula, *Blyth, J. A. S. B.* xiv, p. 340; *id. Cat.* p. 30; *Jerdon, Mam.* p. 36.
Vesperugo noctula, *Dobson, Mon. As. Chir.* p. 88; *id. Cat. Chir. B. M.* p. 212; *Anderson, Cat.* p. 126; *Scully, J. A. S. B.* lvi, pt. 2, p. 250.

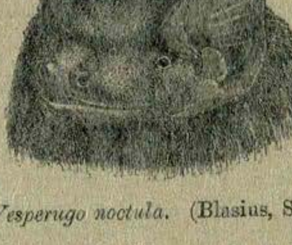

Fig. 93.—Head of *Vesperugo noctula*. (Blasius, Säugeth. Deutschlands.)

Ears thick, broadly rounded above, nearly as broad as long, extending very little beyond the eye when laid forward; outer margin convex and reflected backward, slightly notched below the base of the tragus, forming a thickened convex lobe in front of the notch and terminating behind the angle of the mouth; inner margin nearly straight above, convex below; basal lobe moderately rounded. Tragus short, expanded above, curved inwards, broadest near the top, which is round; outer margin very convex, with a small pointed projection at the base; inner margin concave.

Head broad and flat, the glandular swellings at the sides of the muzzle very pronounced; nostrils projecting and directed outwards and downwards, space between them concave. Thumb short, with a small callosity at the base. Feet thick, toes short. Wing-membranes from the ankle. Postcalcaneal lobe well developed, rounded. Only the tip of the tail is free.

Inner upper incisor bicuspid in the young only, the small outer cusp disappearing in adults; outer incisor much shorter than the inner, but much broader in transverse section at the base, and having the crown hollowed out to receive the summit of the lower canine. Lower incisors with their broad crowns parallel, oblique to the jaw and overlapping each other. The first upper premolar very small, in the internal angle between the canine and the second premolar, which meet externally.

Colour of fur light yellowish brown, very little paler below, and the hairs on the upper surface paler towards the base. A specimen said to be from Ceylon is rather darker brown. Some European examples are said to be reddish brown.

Dimensions. Head and body 3 inches, tail 2, ear from crown 0·38, forearm 2·1.

Distribution. Found almost throughout the temperate Palæarctic region and widely spread in the Ethiopian. This bat has been found in Nepal and Sikhim, and perhaps in Kandahar; there are specimens in the British Museum labelled Ceylon and Singapore, and the species has been recorded from Sumatra and Java.

Habits. The noctule bat generally rests in trees during the day, though it is sometimes found in considerable numbers in buildings. It appears early in the evening, and has an especially strong and powerful flight, rising high in the air. It haunts wooded country, and lives largely on cockchafers and similar beetles. It hibernates thoroughly, never appearing till late in the spring, and it disappears soon in the autumn. Large numbers are found hibernating together. This species has a strong unpleasant odour. A good account of some of its habits, and especially of the birth of the young, by Mr. G. Daniell, will be found in the Proc. Zool. Soc. for 1834, p. 130. He found only a single young in several females; but Blasius states that two are generally produced. The young are born blind and naked.

182. **Vesperugo leisleri.** *The hairy-armed Bat.*

Vespertilio leisleri, *Kuhl, Deutsch. Flederm.* p. 38 (1817).
Scotophilus leisleri, *Blyth, J. A. S. B.* xxiv, p. 363; *id. Cat.* p. 33; *Jerdon, Mam.* p. 34.
Vesperugo leisleri, *Hutton, P. Z. S.* 1872, p. 707; *Dobson, Mon. As. Chir.* p. 91; *id. Cat. Chir. B. M.* p. 215.

Ears and tragus similar to those of *V. noctula*, as are all details of structure except the dentition. The outer incisors equal to the inner in cross section at the base, but much shorter. Lower incisors in a semicircle scarcely overlapping each other. In this bat, as in the noctule, a band of fine short hair passes on the underside behind the forearm to the carpus, hence the English name.

Colour of fur bright yellowish brown above, light brown below, the basal three fourths of the hairs on both surfaces dark brown.

Dimensions. Head and body 2·4 inches, tail 1·6, ear from crown 0·25, forearm 1·65.

Distribution. Europe and the temperate regions of Asia. There are in the British Museum specimens collected by Hutton at Mussoorie, whence also the species was recorded by Blyth. It does not appear to have been observed elsewhere in the Himalayas.

Habits imperfectly known, Blasius saying that this species is a high-flyer and tree-haunter like *V. noctula*; whilst Bell in his 'British Quadrupeds' doubts its dwelling in trees, and states that its flight is much less steady and powerful than that of the noctule. It appears early in the evening.

There is in the British Museum a skin of *V. imbricatus*, marked Calcutta, and sent by Blyth to the East India Company's Museum. As the species is not mentioned by Blyth, and no specimens collected by him are in the collection at Calcutta, it is doubtful if the specimen above noticed is Indian. The species, which is found in the Malay Peninsula and Java, may be recognized by its comparatively large well-rounded ears, and its crescentic pointed tragus. The forearm measures 1·4.

183. **Vesperugo mordax.** *The grizzled Bat.*

? Scotophilus maderaspatanus, *Gray, List Mam. B. M.* p. 29 (1843), no description.

Vesperugo mordax, *Peters, MB. Akad. Berlin,* 1866, p. 402; *Dobson, Rep. Brit. Assoc.* 1880, p. 184; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 265.

Pipistrellus austenianus, *Dobson, P. A. S. B.* 1871, p. 213.

Vesperugo maurus, *Dobson, Mon. As. Chir.* p. 99; *id. Cat. Chir. B. M.* p. 218, partim, *nec Blasius*; *Anderson, Cat.* p. 127.

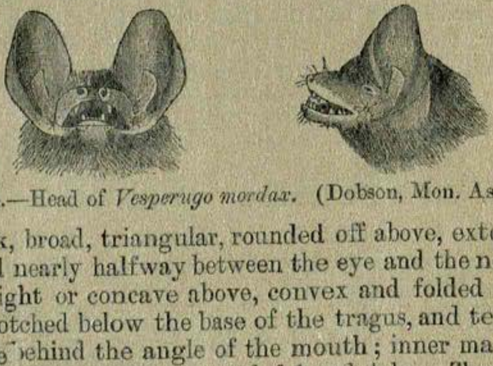

Fig. 94.—Head of *Vesperugo mordax.* (Dobson, Mon. As. Chir.)

Ears thick, broad, triangular, rounded off above, extending when laid forward nearly halfway between the eye and the nostril; outer margin straight or concave above, convex and folded back below, distinctly notched below the base of the tragus, and terminating in a small lobe behind the angle of the mouth; inner margin straight above, convex below, with a rounded basal lobe. Tragus broadest

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above the middle of the inner margin, which is straight; outer margin very convex above, tip rounded; at the base of the outer margin a pointed lobe, and above it a second very small projection, indistinct in some specimens.

Muzzle broad and flat, nostrils opening on a level with the muzzle. Wings from the base of toes. Postcalcaneal lobe well developed, rounded. Last caudal vertebra free.

Upper incisors nearly equal in length, inner bifid; the outer cusp smaller, directed inwards, and disappearing with age. Lower incisors overlapping each other. First upper premolar small, quite internal to the tooth-row, but visible from without.

Colour of fur black or dark sooty brown, the hairs on the back behind the shoulders and on the lower parts with light grey tips. Membranes black; ears, nose, and skin of face the same.

Dimensions. Head and body 1·9 inches, tail 1·6, ear from crown 0·35, forearm 1·55.

Distribution. India (Kumaun, Sind, Allahabad, Deccan, Khási hills, Assam) and Java. Probably throughout the Oriental region, replacing the Palæarctic *V. maurus* (or *V. savii*), which is a smaller species, widely distributed from the Canary Isles to China.

184. **Vesperugo affinis.** *The chocolate Bat.*

Pipistrellus affinis, *Dobson, P. A. S. B.* 1871, p. 213.
Vesperugo affinis, *Dobson, Mon. As. Chir.* p. 102; *id. Cat. Chir. B. M.* p. 220; *Anderson, An. Zool. Res.* p. 100, pl. iv, figs. 7, 8; *id. Cat.* p. 128.

Ears broad, rounded, outer margins without emargination or lobe, inner margins convex; a small tubercle with long hairs between the end of the outer margin and the angle of the mouth. Tragus with the inner margin straight; outer margin convex above, and having a small pointed lobe at the base, tip rounded.

Head flat; glands at the side of the muzzle much developed so as to produce a depression in the middle of the face behind the nostrils; anterior portion of face almost naked. The nostrils open sublaterally. Wing-membrane from the base of the outer toe, which is shorter than the others. Feet small. Tail long, of nine vertebræ, the last free. Upper incisors nearly equal in length; first upper premolar minute, internal.

Colour of fur chocolate-brown above, lighter on the head and neck; below dark brown, with light brown or ashy tips; on the pubes and along the thighs white or very pale buff.

Dimensions. Head and body 1·9 inches, tail 1·65, ear from base of outer margin 0·6, forearm 1·55.

Distribution. Bhámo, Upper Burma. A single specimen, now in the Indian Museum, Calcutta, was obtained by Dr. Anderson.

The above description is that of Dobson, slightly condensed. This bat is distinguished from *V. mordax* by colour, by the want of a notch in the outer ear-margin, and by the number of caudal vertebræ.

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185. **Vesperugo circumdatus.** *The black Bat.*

Vespertilio circumdatus, *Temminck, Mon. Mam.* ii, p. 214, pl. 53, figs. 3, 4 (1835-41).
Vesperugo circumdatus, *Dobson, Cat. Chir. B. M.* p. 221.

Ears with rounded tips, outer margin concave below the rounded tip, then convex, notched opposite the base of the tragus, terminating in a convex lobe; inner margin straight above, convex below. Tragus broadest about the middle of its inner margin, terminating above in an acute angle, inner margin slightly concave, outer with a lobule at the base.

Nostrils scarcely projecting, opening sublaterally, the space between them concave. Terminal third of the muzzle half naked. Wings from the base of the toes; no postcalcaneal lobe; half the last caudal vertebra free. Inner upper incisors long and strong, faintly bifid, outer very small; first upper premolar minute, in the inner angle between the closely approximated canine and second premolar. Lower incisors transversely placed at right angles to the jaws.

Colour of fur above intensely black, the extreme tips of some of the hairs bright ferruginous; beneath dull black, the tips of the hairs greyish. Membranes black. According to Temminck the black ears are margined by white, but this is not seen in dried specimens.

Dimensions of type from Java. Head and body about 2·4 inches, tail 1·3, ear from base of outer margin 0·5, forearm 1·5. In the only Indian specimen known the forearm measures 1·65.

Distribution. India and Java. The only specimen known from India is one presented by Jerdon to the British Museum, and this has no locality attached, but in all probability it was collected in Southern India.

186. **Vesperugo ceylonicus.** *Kelaart's Bat.*

Scotophilus ceylonicus, *Kelaart, Prod.* p. 22 (1852).
Vesperugo indicus, *Dobson, Cat. Chir. B. M.* p. 222 (1878).
Vesperugo ceylonicus, *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 265.

Ears subtriangular, extending when laid forward two thirds the distance from the eye to the nostril; tips rounded, both margins nearly straight below the rounded tip; the basal lobe scarcely convex, outer margin concave, not notched, opposite the base of the tragus. Tragus varying but little in breadth for some distance above the base of the inner margin, which is straight; outer margin convex above, meeting the inner in an obtuse point, and bearing a distinct triangular lobe at the base.

Muzzle broad, sides swollen, middle of upper surface depressed. Wings from the metatarsus. Postcalcaneal lobe well developed. Extreme tip of tail free.

Inner upper incisors bifid, the outer pair but little shorter than the outer and small cusps of the inner, and exceeding the inner in cross section at the base. The crown of the outer incisors is

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hollowed out, as in *V. noctula*, to receive the point of the lower canine, and thus may appear bifid or trifid.

Colour of fur reddish brown above, hairs of the same tint from base to tip, pale brown below; the tips rather paler than the basal portion of the hairs.

Dimensions of a male from the Wynaad. Head and body 2 inches, tail 1·6, ear from crown 0·45, forearm 1·65, tibia 0·58.

Distribution. Ceylon and the Malabar coast of India. A specimen presented by Sir W. Elliot to the British Museum and labelled Madras is probably from the Western Gháts.

187. **Vesperugo abramus.** *The Indian Pipistrelle.*

? Vespertilio de Coromandel, *F. Cuv. Nouv. Ann. Mus. Hist. Nat.* i, p. 21 (1832).
Vespertilio imbricatus, *Temminck, Mon. Mam.* ii, p. 216, *nec Horsfield.*
Vespertilio abramus, *Temminck, ib.* p. 232 (1835–41).
Vespertilio coromandelicus, *Blyth, J. A. S. B.* xx, p. 159 (1851).
? Myotis parvipes, *Blyth, J. A. S. B.* xxii, p. 581; *Jerdon, Mam.* p. 46.
Scotophilus coromandelianus, *Blyth, Cat.* p. 33; *Jerdon, Mam.* p. 35.
Vesperugo imbricatus *and* V. micropus, *Hutton, P. Z. S.* 1872, pp. 707, 708.
Vesperugo abramus, *Dobson, Mon. As. Chir.* p. 97; *Cat. Chir. B. M.* p. 226; *Anderson, Cat.* p. 129; *Scully, J. A. S. B.* lvi, pt. 2, p. 250; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 266.

Ears subtriangular, rounded at the tips, when laid forward extending to about halfway between the eye and the nostrils, outer margin nearly straight or slightly concave; the concavity opposite the base of the tragus is slight; in front of this is a prominent lobe, terminating behind the angle of the mouth. Tragus a little curved forward, tip rounded, inner margin slightly concave, outer convex, with the usual small lobe at the base and only a slight concavity above it (see fig. 73, p. 252).

Muzzle blunt, glandular swellings on the sides well developed, the face behind them depressed; crown of the head and forehead between the eyes thickly furred; muzzle, extending back to the ears and including the eyes, almost naked in adults. Feet small. Wing-membrane from the base of the toes. Postcalcaneal lobe well developed, rounded. Last rudimentary caudal vertebra free. Penis longer in proportion than in any other bat.

Upper inner incisor bifid, the small external cusp placed slightly posteriorly, often difficult to distinguish. Outer incisor nearly as long as the inner and exceeding the outer cusp of the latter in length. The second upper premolar separated from the canine by a slight interval.

Colour of fur dark brown above, a little paler below; head and neck often with a yellowish tinge. All the basal portion of the hairs, frequently amounting to three fourths of their length, black.

Dimensions. Head and body 1·8 inches, tail 1·4, ear from crown 0·3, forearm 1·3.

GSL

Distribution. This is perhaps the commonest bat in India, and appears to be found throughout the Peninsula, Ceylon, and Burma. It ascends the Himalaya to at least 7000 feet, and is met with commonly in Sind and the Punjab. Beyond Indian limits it inhabits the whole Oriental region and a considerable part of the Palæarctic, its range extending to Northern Australia in one direction, and, in the summer at all events, to Central Europe and even to Sweden in the other.

Habits. Probably one cause why this species is so frequently observed in India is that it is especially a house bat, hiding in roofs, outhouses, and old buildings during the day, rather than in woods, and flying early in the evening, often close to human habitations. It frequently comes into rooms at night. Its flight is very quick, but very irregular; after going a short distance it often drops suddenly, doubtless in order to seize an insect, and it frequently keeps about the same spot for a considerable time. I cannot say that it hibernates in India, but certainly this and other bats disappear almost entirely during the cold season from November to the end of February in Northern India. In temperate climates it is said to sleep throughout the winter. Blasius found two young in all pregnant females examined by him.

188. **Vesperugo pipistrellus.** *The common Pipistrelle.*

Vespertilio pipistrellus, *Schreb. Säugth.* i, p. 167, pl. 54 (1775).
? Vespertilio pallidiventris, *Hodgson, Calc. Journ. N. H.* iv, p. 286 (no description; see *Blyth, J. A. S. B.* xx, p. 159, note).
Myotis pipistrellus, *Blyth, J. A. S. B.* xxi, p. 360; *id. Cat.* p. 35.
Vesperugo pipistrellus, *Dobson, Mon. As. Chir.* p. 95; *id. Cat. Chir. B. M.* p. 223; *id. Second Yarkand Miss., Mam.* p. 1[illegible]; *Anderson, Cat.* p. 128; *Scully, P. Z. S.* 1881, p. 200; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 267.

Ears subtriangular, tip rounded, outer margin nearly straight for one third its length below the rounded tip, then suddenly curved out into a prominent lobe. There is a slight concavity opposite the base of the tragus, and in front of this a prominent convex lobe. Tragus very similar to that of *V. abramus*, but the inner margin is less concave. Muzzle better clad than in *V. abramus*.

Inner upper incisors bifid, the outer cusps smaller and posteriorly situated; each outer incisor sometimes as long as the outer cusp of the inner, sometimes shorter. In all other details of structure this bat agrees with *V. abramus.*

Colour of fur moderately deep rufous-brown above, paler below; basal half to three fourths of all hairs black. Specimens from dry sandy districts are paler, sometimes almost white below.

Dimensions. Head and body 1·65 inches, tail 1·4, ear from crown 0·3, forearm 1·25.

Distribution. The Palæarctic region, generally distributed. Within Indian limits this species has only been recorded with certainty from Gilgit and the valley of Kashmir.

Habits. Very similar to those of *V. abramus.* Like that species, the common pipistrelle is very often seen about human habitations, and it has the same rapid flight with frequent very quick turns and descents. It is said to live chiefly on gnats, and may be seen hawking them on summer evenings. During the day it hides in crevices of walls, clefts of rocks, or any dry protected hole, less frequently in trees. It appears early in the spring, and is sometimes found abroad on warm days in the winter, and it is usually the first bat to appear in the afternoon. The female bears sometimes one, sometimes two young.

189. **Vesperugo kuhli.** *The white-bordered Bat.*

Vespertilio kuhlii, *Natterer, Kuhl, Deutsche Flederm.* p. 55 (1817).
Pipistrellus lepidus, *Blyth, J. A. S. B.* xiv, p. 340 (1845).
Nycticejus canus, *Blyth, Cat.* p. 32; *Jerdon, Mam.* p. 38.
Scotophilus lobatus, *Jerdon, l. c.* p. 35 (*? Gray, List Mam. B. M.* p. 29).
Vesperugo (Pipistrellus) leucotis, *Dobson, J. A. S. B.* xli, pt. 2, p. 222.
Vesperugo kuhlii, *Dobson, Mon. As. Chir.* p. 94; *id. Cat. Chir. B. M.* p. 230; *id. J. A. S. B.* xlvi, pt. 2, p. 311; *Anderson, Cat.* p. 131; *Scully, A. M. N. H.* ser. 5, vol. viii, p. 223 (1881); *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 267.

Ears larger than in *V. abramus*, extending when laid forward more than halfway between the eye and the nostril, subtriangular; tips rounded; outer margins nearly straight, slightly concave just below the tip, with a small emargination opposite the base of the tragus, and a not very prominent lobe (much less convex than in *V. abramus*) at the end behind the angle of the mouth. Inner margin nearly straight. Tragus rounded at the tip, broadest below the middle of the inner margin, which is straight; outer margin convex, especially in the middle, and having a small pointed lobe at the base.

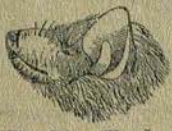

Fig. 95.—Head of *V. kuhli.* (Dobson, Mon. As. Chir.)

In other details of structure (except in the teeth) there is no important difference from *V. abramus.* The outer upper incisors are very short, only about one fourth the length of the inner, which are long and pointed, not bifid.

Colour of fur yellowish or greyish brown above, paler, often whitish, below, the basal two thirds to three fourths of the hairs black, both above and below. Some specimens are much darker than others. Membranes and ears usually dark, the hinder border of the interfemoral and wing-membranes more or less bordered with white. In specimens from Cutch, Sind, Baluchistan (*Pipistrellus lepidus*, Blyth, *P. leucotis*, Dobson), and the neighbouring countries the tips of the fur are light yellowish brown, the ears, interfemoral and antebrachial membranes, and wing-membrane near the sides of the body are white, and the remainder of the wing-membrane traversed by white reticulations.

Dimensions. Head and body 1·75 inches, tail 1·5, ear from crown 0·4, forearm 1·4.

Distribution. Europe south of the Alps, Northern Africa, and Southern Asia. In India this species is widely, perhaps generally distributed, being common in Sind, the Punjab, and the neighbouring countries, and recorded from several parts of the Bengal and Madras Presidencies. It has not been hitherto noticed east of Cachar, nor obtained from the Himalayas nor from Ceylon.

Habits. The flight is not unlike that of *V. abramus*, but less rapid and with rather fewer sudden turns. The female has been found, both in Europe and India, to have two young at a birth.

190. **Vesperugo annectens.** *The intermediate Bat.*

Pipistrellus annectans, *Dobson, P. A. S. B.* 1871, p. 213.
Vesperugo annectens, *Dobson, Mon. As. Chir.* p. 116; *id. Cat. Chir. B. M.* p. 234; *Anderson, Cat.* p. 132.

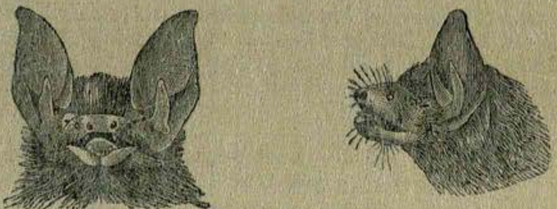

Fig. 96.—Head of *Vesperugo annectens.* (Dobson, Mon. As. Chir.)

Ears bluntly pointed, the tips rounded, outer margin hollowed out immediately below the tip, then convex, again slightly concave opposite the base of the tragus, and terminating in a small rounded lobe. Tragus long, subacutely pointed, inner margin almost straight, outer slightly convex, with a small rounded lobe at the base.

Head slightly elevated; the fur covers the whole face except the nostrils, and forms a thick fringe to the upper lip; the glandular prominences on the side of the muzzle are small, they and the sides of the face are less thickly covered with hair than the upper surface. No postcalcaneal lobe; extreme tip of tail free.

Upper incisors nearly equal, the inner pair slightly notched at the extremity. First upper premolar minute, placed slightly inside the tooth-row, but distinctly visible from without.

Colour of fur, so far as can be ascertained from a specimen in spirit, dark brown above with paler tips; beneath brown, the tips reddish.

Dimensions. Head and body 2 inches, tail 1·6, ear from base of outer margin 0·6, forearm 1·8.

Distribution. Nága hills, Assam. The only specimen obtained is in the Indian Museum, Calcutta. A skin, probably belonging to the same species, is amongst Mr. Hodgson's Nepal collections in the British Museum.

This species has the dentition of *Vesperugo* and the hairy face, the ear, and tragus of *Vespertilio*. The above is Dobson's description, slightly abridged.

191. **Vesperugo tickelli.** *Tickell's Bat.*

Nycticejus tickelli, *Blyth, J. A. S. B.* xx, p. 157 (1851); *id. Cat.* p. 31; *Kelaart, Prod.* p. 24.
Nycticejus isabellinus, *Blyth, Horsfield Cat.* p. 38 (no description).
Vesperugo tickelli, *Dobson, Mon. As. Chir.* p. 113; *id. Cat. Chir. B. M.* p. 240; *id. J. A. S. B.* xlvi, pt. 2, p. 312; *Anderson, Cat.* p. 132.

Ears oval, rounded at the tips, extending when laid forwards to about halfway between the eye and the nostril; outer margin concave opposite the base of the tragus, and terminating in a rounded thickened lobe behind the angle of the mouth. Tragus lunate, curved forward, bluntly pointed, inner margin concave, outer very convex with a small lobe at the base.

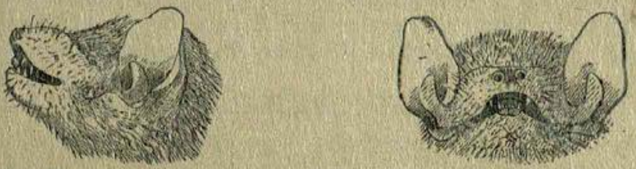

Fig. 97.—Head of *Vesperugo tickelli.* (Dobson, Mon. As. Chir.)

Muzzle blunt, swollen at the sides, slightly depressed above in the middle. Wings from the base of the toes. A distinct post-calcaneal lobe; tail long, only the tip free. The fur extends forward on the middle of the face far in front of the eyes; sides of face including the eyes and extending to the ears, together with the terminal portion of the face, nearly naked.

Inner upper incisors large, unicuspidate, and situated near the canines, the outer incisors small, each placed behind the inner, in the angle between it and the canine. Thus on looking into the mouth only two upper incisors are seen, the small outer incisors looking like their basal cusps. No anterior upper premolar.

Colour of fur light greyish brown above, generally with a rufous tinge on the lower back; hairs, except the rufous tips, of the same colour throughout; below buff. Membranes dusky, paler along the digits and on the interfemoral.

Dimensions. Head and body 2·6 inches, tail 2, ear from crown 0·4, forearm 2·1.

Distribution. Peninsula of India (Nusseerabad in Rajputana; Bombay; Chybassa, Jashpur, Sirguja in S.W. Bengal), Ceylon, Andaman Islands, and near Moulmein in Burma.

192. **Vesperugo blanfordi.** *Limborg's Bat.*

Vesperugo (Hesperoptenus) blanfordi, *Dobson, J. A. S. B.* xlvi, pt. 2, p. 312; *id. Cat. Chir. B. M.* p. 242; *Anderson, Cat.* p. 133.

Ears short, subtriangular, tips broadly rounded, upper half of outer margins straight, then convex, slightly concave opposite the base of the tragus, and terminating abruptly in a deep lobe closer to the angle of the mouth than to the base of the tragus; tragus narrowest opposite to the base of its inner margin, expanded above and curved inwards.

Head very flat and broad; nostrils wide apart, semilunate. Feet very small, the sole of the feet forming a cushion, probably adhesive, but not expanded as in *V. pachypus*. Postcalcaneal lobe very large, broader than the foot, and with a median cartilaginous support, the extreme tip of the tail alone projecting. In all other details, this species, though less than half the size, exactly resembles *V. tickelli*, and the dentition is similar, the outer incisors being proportionally even smaller and placed more behind the inner.

Colour of fur dark reddish brown above, slightly paler beneath.

Dimensions. Head and body 1·75 inches, tail 1·1, ear from base of outer margin 0·45, forearm 1·1.

Distribution. The type was obtained by Mr. Limborg east of Moulmein in Burmah, together with *V. tickelli*; another specimen has been found at Johore in the Malay Peninsula.

Genus **NYCTICEJUS**, Rafinesque (1819).

Syn. *Scotophilus*, Leach (1822).

Head short and broad; ears far apart, usually short, rounded at the tips, generally with the basal lobe of the inner margin well developed and its inner termination free; tragus well developed; muzzle broad and swollen, nearly naked; nostrils near together, opening by simple lunate apertures in front or sublaterally.

Membranes thick and leathery, as a rule quite naked, the fur confined to the body. Wing-membranes from the base of the toes. Limbs stout. Tail long, but shorter than the head and body.

Dentition: i. $\frac{1-1}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{1-1}{2-2}$ or $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Four upper milk-incisors. Upper incisors long, unicuspidate, with their bases usually close to those of the canines. Upper premolar (or second, if there are two) large, exceeding the molars in height, close to the canine. Last upper molar small.

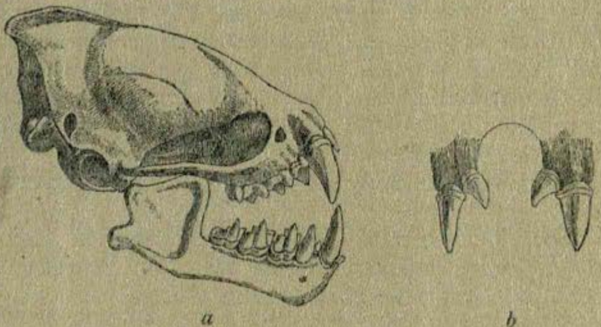

Fig. 98.—*a*, Skull of *Nycticejus kuhli.* *b*, Upper canine and incisor teeth.

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The genus ranges throughout the Ethiopian and Oriental regions and extends to Australia on one side, and to N. America on the other. Mr. Thomas has recently shown (Ann. Mus. Civ. Genova, ser. 2 *a*, ix, p. 88) that the genera *Scotophilus* and *Nycticejus* must be reunited.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Two upper premolars on each side; forearm 1·4	*N. dormeri*, p. 319.
B. One upper premolar on each side.	
a. Basal lobe of ear angular; tragus with a prominent rib across front surface; forearm 1·9 to 2·7 inches	*N. kuhli*, p. 320.
b. Basal lobe rounded; tragus without rib.	
a′. Fur without white spots.	
a″. Basal lobe of ear terminating internally in a rounded free lobule in front of tragus; forearm 2·2	*N. emarginatus*, p. 321.
b″. Basal lobe rounded, not produced internally; forearm 1·4	*N. pallidus*, p. 322.
b′. Fur with white spots; forearm 2·3	*N. ornatus*, p. 322.

193. **Nycticejus dormeri.** *Dormer's Bat.*

Scotozous dormeri, *Dobson, P. Z. S.* 1875, p. 373.
Vesperugo dormeri, *Dobson, Mon. As. Chir.* p. 118; *id. Cat. Chir. B. M.* p. 243.

Ears subtriangular, tips rounded, margins below the tips nearly straight, inner margin slightly emarginate at the base, but without any distinct basal lobe; outer margin concave opposite the base of the tragus, and ending in a rounded lobe. Tragus straight, pointed, a small lobe at the base of the outer margin, the two margins nearly parallel for some distance, but the terminal third of the outer margin slopes inwards and meets the inner margin at an acute angle.

Muzzle blunt without any median depression above, glands at side swollen; face in front of eyes, and comprising the area around the eyes, almost naked; nostrils opening sublaterally. Postcalcaneal lobe distinct. Tip of the tail projecting.

A single large unicuspidate upper incisor on each side close to the canine directed forward and inward. Lower incisors crowded, middle pair larger than the others, all distinctly trifid. Two upper premolars, first very minute, second large, not quite close to the canine. First lower premolar broader, but shorter than the second.

Colour of fur above dark brown with ashy tips, below dirty white, the basal portion of the hairs very dark brown.

Dimensions. Head and body about 1·75 inches, tail about 1·25 forearm 1·4.

Distribution. The Peninsula of India. The type specimen was found near Bellary, and I obtained two individuals in South-east Berar, near Chánda.

This species has generally been placed in *Vesperugo*, and is intermediate in character between that genus and *Nycticejus*.

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94. Nycticejus kuhli. *The common yellow Bat.*

Scotophilus kuhlii, *Leach, Tr. L. S.* xiii, p. 72 (1822); *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 267.
Vespertilio temminckii, *Horsf. Res. Java* (1824).
Nycticejus heathii, *Horsf. P. Z. S.* 1831, p. 113.
Vespertilio belangeri (*and* V. noctulinus?), *Is. Geoffr. Bélanger, Voy Ind. Or.* pp. 87, 92, pl. 3 (1834).
Scotophilus temminckii, *Cantor, J. A. S. B.* xv, p. 185; *Dobson, P. Z. S.* 1875, p. 370; *id. Mon. As. Chir.* p. 120; *id. Cat. Chir. B. M.* p. 258; *Anderson, Cat.* p. 133.
Nycticejus heathi, N. belangeri, *and* N. luteus, *Blyth, J. A. S. B.* xx, p. 157.
Nycticejus temmincki, N. flaveolus, *and* N. castaneus, *Horsf. Cat.* pp. 37, 38.
Nycticejus heathii *and* N. belangeri, *Kelaart, Prod.* p. 23.
Nycticejus temminckii, *Blyth, J. A. S. B.* xxi, p. 345.
Nycticejus heathii, N. luteus, N. temminckii, *and* N. castaneus, *Blyth, Cat.* pp. 30, 31; *Jerdon, Mam.* pp. 37, 38.
Nycticejus luteus, *Hutton, P. Z. S.* 1872, p. 706.

Ears short, extending but little in front of the eyes when laid forward, subtriangular, the tips rounded, outer margin below tip nearly straight, deeply notched opposite the base of the tragus and terminating in a very convex lobe; upper half of inner margin of ear-conch slightly convex, then there is a blunt obtuse angle, and the lower half is straight; at the base the margin turns by another obtuse angle into the straight-edged basal lobe, the inner termination of which is free and pointed. Tragus long, narrow and attenuate towards the slightly rounded tip, much curved forward and inward; inner margin concave, outer convex with a small lobe at the base; from the base of the inner margin a narrow prominent rib passes across the front surface, sloping somewhat upwards.

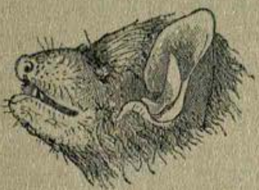
Fig. 99.—Head of *N. kuhli*. (Dobson, Mon. As. Chir.)

Muzzle thick; head broad; face nearly or quite flat, no depression behind the muzzle or in the middle. Postcalcaneal lobe narrow. Only the extremity of the tail projecting. The fur is short.

Skull thick, with prominent crests; the anterior surface slopes evenly down from the occiput to the nose. Upper incisors close to the canines, the bases of the teeth in contact; there is a distinct but not large expansion behind the base of each upper incisor, forming a cingulum. One upper premolar. First lower premolar small, appearing as if compressed between the canine and second premolar, which is higher than the molars (fig. 98, p. 318).

Colour of fur variable, generally yellowish brown above, the basal portion of the hairs paler, dull buff or yellowish grey below. The colour of the upper surface, however, varies to deep or bright chestnut, golden brown, or to greyish brown, whilst the lower parts are yellow or dirty white.

Dimensions very variable. In a specimen of ordinary size the head and body are 3 inches long, tail 2, forearm 2·1, ear from crown 0·35. In some adults the forearm is less than 2 inches. But large individuals occur, both males and females, with a forearm from 2·4 to 2·7. These have generally been separated as a distinct species under the name of *N. heathi*, but Dobson has classed them as a variety. I cannot but think he is right, though certainly the difference is very remarkable.

Distribution. The whole Oriental region from Sind to Borneo and the Philippines. Common nearly throughout India, Ceylon, Assam, and Burma, but, I think, less abundant in forest-regions than in cultivated tracts. This species is said by Hutton to occur at low elevations not exceeding about 3000 feet on the Western Himalayas. I cannot find it recorded from Nepal or Sikhim.

Habits. Not only is this bat very common throughout India, but it is one of the first to appear in the evening, so that it is seldom wanting in any collection of Indian *Chiroptera*. It flies more slowly and steadily than the species of *Vesperugo* in general. In the daytime it has been found by Hutton singly, in pairs, or in small parties of five or six in outhouses, sheds, verandahs, temples, &c. In Java, according to Horsfield, it collects by hundreds in the trunks and hollows of trees, and feeds chiefly on "white ants."

Mr. Oldfield Thomas has recently ascertained that the immature type of *Scotophilus kuhlii* in the British Museum undoubtedly belongs to the present species.

195. **Nycticejus emarginatus.** *The large-eared yellow Bat.*

Nycticejus emarginatus, *Dobson, P. A. S. B.* 1871, p. 211.
Scotophilus emarginatus, *Dobson, Mon. As. Chir.* p. 123; *id. Cat. Chir. B. M.* p. 262; *Anderson, Cat.* p. 136.

Ears large, with broadly rounded tips; inner margin convex, with a rounded lobe at the base, passing in front of the inner margin of the tragus and resting on part of its anterior surface; outer margin abruptly emarginate below the tip, ending below in a rounded lobe; tragus moderately long, without any ridge on the front surface, slightly curved inwards and obtusely pointed, maintaining almost the same breadth from the base to within a short distance from the tip, above this there is a rapid diminution in the width.

Head broad and flat; muzzle thick and obtuse; glands of the upper lip largely developed, forming rounded prominences between the nostrils and eyes. Last tail-vertebra free. Fur short and close.

Colour of fur throughout at the base dark ferruginous brown, then buff, on the upper parts alone yellowish-brown tips are added.

Dimensions. Head and body 2·9 inches, tail 2·2, ear (from base of outer margin) 0·85, forearm 2·2.

Distribution. The only known specimen, the type in the Indian Museum, Calcutta, is from an unknown locality in India. The above description is slightly abridged from Dobson's.

196. **Nycticejus pallidus.** *The desert yellow Bat.*

Scotophilus pallidus, *Dobson, Mon. As. Chir.* p. 186; *id. Cat. Chir. B. M.* p. 264; *id. J. A. S. B.* xlvi, pt. 2, p. 310; *Anderson, Cat.* p. 137.

Ears thick and short, tips broadly rounded, margins convex, basal lobe round; outer margin emarginate opposite base of tragus and ending in a convex lobe; tragus moderately long, not attenuate, rounded at the tip, inner margin straight or slightly concave, outer moderately convex, with a prominent pointed lobe at the base.

Muzzle and teeth as in *N. kuhli*. Tip of the tail free.

Colour of fur above light chestnut-brown, beneath brownish buff, basal portion of hairs on both surfaces pale buff. In some specimens the fur and membranes are all pale buff throughout.

Dimensions. Head and body 2 inches, tail 1·4, ear from crown 0·35, forearm 1·4.

Distribution. Sind and the Punjab.

197. **Nycticejus ornatus.** *The harlequin Bat.*

Nycticejus ornatus, *Blyth, J. A. S. B.* xx, pp. 159, 517, xxvi, p. 285; *id. Cat.* p. 30; *Jerdon, Mam.* p. 39.
Nycticejus nivicolus, *Hodgson, Horsfield, A. M. N. H.* (2) xvi, 1855, p. 104; *Jerdon, l. c.* p. 39.
Scotophilus ornatus, *Dobson, P. Z. S.* 1875, p. 371; *id. Mon. As. Chir.* p. 124; *id. Cat. Chir. B. M.* p. 265; *Anderson, An. Zool. Res.* p. 99; *id. Cat.* p. 137; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 268.

Ears of moderate size, subtriangular, with rounded tips; outer margin slightly concave below the tip, then convex, emarginate opposite the base of the tragus and ending in a rounded lobe; inner margin slightly convex above, ending in a well-rounded basal lobe, the free inner extremity of which is a rounded point. Tragus long, bluntly pointed, inner margin nearly straight, becoming concave above, outer margin convex, ending in a pointed projecting lobe at the base.

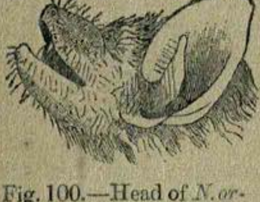

Fig. 100.—Head of *N. ornatus.* (Dobson, Mon. As. Chir.)

Muzzle broad, much swollen, nearly naked; the swollen terminal naked portion stands out abruptly, above and at the sides, just in front of the eyes, from the hinder part of the face, which is covered above with long hair; sides of the face thinly clad. The fur generally softer and longer than in *N. kuhli*. Tail long, only the tip free.

The premaxillary bones are more developed than in *N. kuhli*, and the incisors are separated from the canines by a space, even at the base.

Colour of fur brownish yellow above, almost orange-brown, with some white spots; the hairs dark brown at the base, then isabelline, the tips brownish yellow. A small elongate patch of pure white on the crown of the head; a narrow white stripe down the middle of the back (this is said to be interrupted in some specimens), and two spots, just above the wing-membrane, behind each shoulder. In front of each shoulder is the termination of a broad white V-shaped band extending to the abdomen; there is another white band forming a collar commencing beneath each ear and running forward to the chin. Remainder of the lower parts brown. The size of the white patches varies, being larger in males; in females the markings are much less distinct. The limbs and digits and a variable portion of the membranes are sometimes tawny red.

Dimensions. Head and body 3·1 inches, tail 2·5, ear from crown 0·55, forearm 2·3.

Distribution. The Eastern Himalayas, Khási hills, and some of the ranges of Upper Burma and Yunnan. According to Jerdon, this bat inhabits warm valleys near Darjiling, whilst Hodgson's *Nycticejus nivicolus*, which an examination of Hodgson's drawings in the British Museum shows to be the same, is said to be from the northern region of the Sikhim Himalaya near the snows. Jerdon's account is doubtless correct; some of Hodgson's specimens from the interior of the hills, although obtained near high mountains, were from the deep valleys at low elevations above the sea.

Genus **HARPYIOCEPHALUS**, Gray (1842).

Syn. *Murina*, Gray (1842).

Muzzle elongate, but varying in breadth, crown of the head scarcely raised above the face-line Nostrils prominent, tubular, produced beyond the upper lip, with a circular orifice opening more or less laterally, the outer margin cleft; end of the nose between the nostrils concave. Ears thin, generally covered with glandular papillæ; tragus long, attenuate towards the tip, and inclined outwards. Thumb very large, with a large strongly curved claw. Wings broad, interfemoral membrane much covered with hair above.

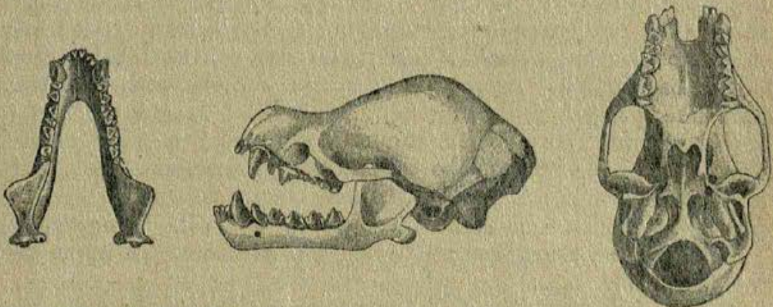

Fig. 101.—Skull of *Harpyiocephalus cyclotis*, × 2. (Dobson, Mon. As. Chir.)

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Upper incisors on each side parallel and stout; posterior upper molar small, sometimes absent in the adult.

This genus may be recognized by the peculiar tubular nostrils. The species range from Tibet and Gilgit to Ceylon and the Malay Archipelago, keeping to the hill-tracts.

*Synopsis of Indian, Ceylonese, and Burmese Species**.

A. Upper third of outer margin of ear-conch concave or emarginate.	
a. First upper premolar not so high as second; forearm 1·4 inches	*H. tubinaris*, p. 324.
b. First and second upper premolars equal in height.	
a′. Ears narrow, pointed; forearm 1·3....	*H. griseus*, p. 325.
b′. Ears broadly rounded off above; forearm 2	*H. harpyia*, p. 325.
B. Upper third of outer margin of ear-conch convex or straight.	
a. Colour ferruginous red above; forearm 1·3.	*H. cyclotis*, p. 326.
b. Colour brown above; forearm 1·3	*H. leucogaster*, p. 327.

I am unable to concur in the reasons which induced Dobson and Peters to prefer *Harpyiocephalus* to *Murina*, both names having been proposed in the same paper; but it appears to me better to continue the use of the first term now that it has, through Dobson's important monographs, obtained general acceptation.

198. **Harpyiocephalus tubinaris.** *Scully's tube-nosed Bat.*

Harpiocephalus tubinaris, *Scully, P. Z. S.* 1881, p. 200.

Muzzle narrow, elongate, hairy. Ears moderate, rounded off at the tips; the outer margin is slightly emarginate in its upper third, then moderately convex, again slightly convex opposite the middle of the tragus, and it terminates in a convex lobe in front of the base of the tragus; inner margin convex, with a distinct spur-like process projecting near the base. Tragus moderately long, tapering above, where it curves outwards; a small pointed lobule above the base of the outer margin, succeeded by a well-marked emargination; above this the tragus attains its greatest breadth, outer margin above this straight at first, the upper half concave; inner margin nearly straight at the base, the upper two thirds concave.

Wings from the side of the proximal phalanx of the outer toe; extreme tip of tail projecting. Interfemoral membrane naked above except at the base between the thighs; wing-membranes clothed close to the body.

Outer upper incisor distinctly shorter than the inner. First upper premolar shorter than the second, which is nearly as high as the canine; last molar a simple transverse plate.

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* Mr. O. Thomas has just found, he informs me, amongst Mr. Fea's collections from Karennee, a new *Harpyiocephalus* allied to *H. auratus* from Eastern Tibet. A description will be published in the Annali Mus. Civ. Genova, ser. 2 *a*, vol. x.

Colour of fur greyish brown above, white below; the basal half of the hairs blackish brown above, dusky beneath.

Dimensions. Head and body 1·8 inches, tail 1·4, forearm 1·4.

Distribution. The only specimen hitherto recorded was obtained by the describer Dr. J. Scully at Gilgit.

This species is allied to the Malay *H. suillus*, but differs in the ear being less emarginate and furnished with a basal spur, in colour, &c.

199. **Harpyiocephalus griseus.** *Hutton's tube-nosed Bat.*

Murina grisea, *Hutton, P. Z. S.* 1872, p. 712.
Harpiocephalus griseus, *Dobson, Mon. As. Chir.* p. 154; *id. Cat. Chir. B. M.* p. 280.

Head conical, muzzle narrow, hairy. Ears small, narrow, bluntly pointed, with narrowly rounded tips, upper third of the outer margin angularly emarginate, middle third convex, lower straight, ending opposite the base of the tragus, which is pointed and slightly curved outwards.

Wings from the base of the toes. Extreme tip of tail only free. Interfemoral membrane densely covered above with rather long hair, which, however, thins out towards the posterior margin.

Upper incisors large, conical, nearly as long as the canine, the inner slightly the larger and having a short posterior blunt cusp arising from the cingulum. Upper premolars equal to each other and to the canine in height. Lower canine short.

Colour above dark brown, with the ends of the hairs yellowish brown; below similar, but the tips are ashy grey.

Dimensions. Head and body 1·4 inches, tail 1·1 (according to Hutton 2 inches and 1), ear outside 0·3, forearm 1·35.

Distribution. The only specimen known was taken at an elevation of 5500 feet by Captain Hutton at Jeripani near Mussoorie in the N.W. Himalayas.

200. **Harpyiocephalus harpyia.** *The hairy-winged Bat.*

Vespertilio harpia, *Temminck, Mon. Mam.* ii, p. 219, pl. 55, figs. 5, 6 (1835–41).
Noctilinia lasyura, *Hodgson, J. A. S. B.* xvi, p. 896 (1847).
Lasiurus pearsonii, *Horsfield, Cat.* p. 36; *Blyth, J. A. S. B.* xx, p. 524; *Jerdon, Mam.* p. 40.
Vespertilio pearsonii, *Tomes, P. Z. S.* 1858, p. 87; *Blyth, Cat.* p. 34.
Murina harpia, *Dobson, P. A. S. B.* 1873, p. 109.
Harpiocephalus harpia, *Dobson, Mon. As. Chir.* p. 155; *id. Cat. Chir. B. M.* p. 281; *Anderson, Cat.* p. 138.

Muzzle thick and blunt, thinly clad in front of the eyes and on the sides of the head. Ear-conch nearly as broad as long, broadly rounded at the tip, outer margin straight below the tip, then slightly emarginate, convex in the middle, again emarginate opposite the base of the inner margin, and terminating in a small lobe in front of the tragus. Inner margin very convex below the middle. Tragus moderately long, slender, attenuated, broadest opposite the base of the inner margin, whence the outer margin slopes rapidly downwards and inwards to the small basal lobe, and gently upwards to the subacutely pointed tip; inner margin straight or very slightly convex throughout.

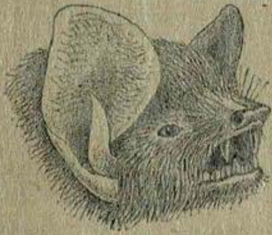

Fig. 102.—Head of *H. harpyia*. (Dobson, Cat. Chir. B. M.)

Wings from the base of the toes. The fur is long, soft, and silky, and extends over the whole upper surface of the interfemoral membrane, the legs, and the wing-membrane as far as beyond a line drawn from the middle of the humerus to the outer toe, being very dense upon the calcanea and backs of the feet. Beneath, the interfemoral membrane bears only a few short scattered hairs. Inner side of ear-conch thinly clad with short fine hair.

Outer upper incisors shorter than the inner; upper premolars subequal, third upper molar deciduous, often wanting. All the teeth very thick and strong, with blunt cusps.

Colour of fur above brownish grey with a ferruginous tinge, hairs with white tips being intermixed on the head, neck, and shoulders; hair of lower back, interfemoral and wing-membranes deep bay. Lower surface of body grey.

Dimensions. Head and body 2·5 inches, tail 2, forearm 2, ear outside from head 0·4.

Distribution. Found at Darjiling and on the Khási hills, also in Sumatra, Java, and Amboyna. A specimen in the British Museum labelled Malabar Coast may be from the hill-range of the Western Ghâts. Probably this handsome bat is widely distributed in the hill-tracts of India and Burma.

Habits. Nothing is known except that fragments of the elytra of beetles have been found in the stomach, and that the teeth appear well suited for crushing the hard cases of Coleoptera. Dobson suggests that *H. harpyia* may feed on beetles with very solid wing-cases.

201. **Harpyiocephalus cyclotis.** *The round-eared tube-nosed Bat.*

Murina suilla, *Blyth, Cat.* p. 34; *Jerdon, Mam.* p. 41; *nec* Vespertilio suillus, *Temm.*
Murina cyclotis, *Dobson, P. A. S. B.* 1872, p. 210; *id. J. A. S. B.* xlii, pt. 2, pl. xiv, fig. 14.
Harpiocephalus cyclotis, *Dobson, Mon. As. Chir.* p. 158; *id. Cat. Chir. B. M.* p. 282; *Anderson, Cat.* p. 139.

Muzzle thick. Ears almost circular, margins convex throughout; there is a small blunt projection to the basal lobe of the inner margin, very different from the pointed spur of *H. leucogaster*. Tragus narrow at the base, then broader, being widest just above

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the base of the inner margin, thence gradually tapering to the end, which is finely subacutely pointed, the inner margin slightly convex throughout, outer straight below the widest part of the tragus, then angulate, concave above.

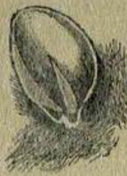

Fig. 103.—Ear of *H. cyclotis*. (Dobson, Mon. As. Chir.)

Wing-membrane from the base of the claw on the outer toe; feet small; only the extreme tip of the tail free. Interfemoral membrane hairy above, hair densest at the root of the tail, along the tibiæ and calcanea. Backs of the feet also thickly furred.

Upper incisors long and slender, the outer the shorter. First and second upper premolars subequal, the first a little the smaller, and about half as high as the canine.

Colour of fur above dark brown with ferruginous, or sometimes with yellowish-brown tips, below paler brown.

Dimensions. Head and body 1·7 inches, tail 1·5, forearm 1·3, ear from crown outside 0·37.

Distribution. A purchased specimen in the British Museum is said, apparently on fair authority, to be from Ceylon. All the other known examples are from the Sikhim Himalayas.

202. **Harpyiocephalus leucogaster.** *The white-bellied tube-nosed Bat.*

Murina leucogaster, *A. Milne-Edwards*, *Nouv. Arch. Mus.* vii, *Bull.* p. 91 (1871); *Rech. Mam.* p. 252, pl. xxxvii B, fig. 2, xxxvii C, fig. 3.

Harpyiocephalus huttonii, *Peters*, *P. Z. S.* 1872, p. 711.

Harpiocephalus leucogaster, *Dobson*, *Mon. As. Chir.* p. 157; *id.* *Cat. Chir. B. M.* p. 283; *Scully*, *J. A. S. B.* lvi, pt. 2, p. 251.

Muzzle thick. Ears oval with convex margins; near the base of the inner margin a small pointed process projects. Tragus attenuated above, pointed and curved outwards, an obtuse lobule just above the base of the outer margin.

Wings from base of claw on outer toe. Fur long and dense. Interfemoral membrane hairy above as in *H. cyclotis*.

Outer upper incisors larger than the inner; first upper premolar smaller than the second, and situated a little inside the general line of the teeth.

Colour of fur above brown, not dark, the hair greyish at the base; beneath, the throat, chest, and abdomen are whitish, the sides of the body pale brown.

Dimensions. Head and body 1·9 inches, tail 1·5, forearm 1·3, ear from crown of head 0·4.

Distribution. This species was obtained by Hutton at Jeripáni near Mussoorie, Scully captured it in Nepal, and there is a skin procured by Hodgson at Darjiling in the British Museum. The original type was from Eastern Tibet.

Habits. According to Hutton, this bat when searching for

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insects, "skims closely and somewhat leisurely over the surface of the crops and grass." One that entered a room kept low down near the floor, instead of flying about the ceiling as most bats do.

Two other species of the genus, *H. suillus* found in the Malay Archipelago, and *H. auratus* from Eastern Tibet, may hereafter be found within Indian limits. Both are small forms with a narrow muzzle.

Genus VESPERTILIO, L. (1766).

Syn. *Trilatitus*, *Myotis*, Gray.

Muzzle long, face hairy; the glandular prominences on each side between the eye and the nostril much less developed than in *Vesperugo*, and scarcely increasing the breadth of the face; nostrils not prolonged, opening sublaterally by crescentic apertures; crown of the head but slightly raised above the face. Ears separate, longer than broad, generally longer than in *Vesperugo*, the internal basal lobe angular, the external margin of the ear-conch terminating below the base of the tragus or very slightly in front, and not carried far forward towards the angle of the mouth. Tragus long, generally attenuated above and pointed.

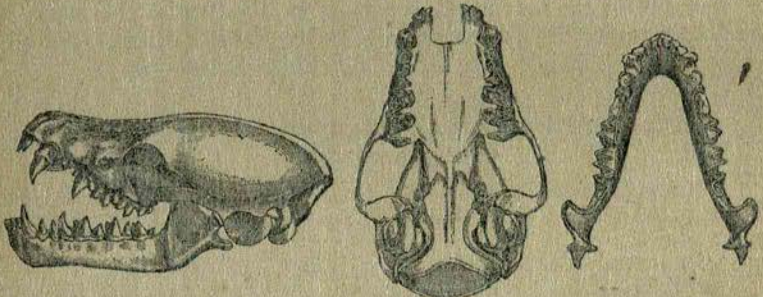

Fig. 104.—Skull of *Vespertilio*, enlarged. (Blasius, Säugeth. Deutschlands.)

Tail less than the head and body (rarely equal); postcalcaneal lobe absent or very small.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$. The upper incisors subequal, in pairs on each side close to the canines, the points of the teeth in each pair generally diverging in direction, the outer incisor pointing slightly outwards, the inner inwards; lower outer incisors much larger than the inner. The first and second upper premolars small, the second always smaller than the first, often minute and internal to the tooth-row. The relative proportions of the three lower premolars are the same, the second being the smallest, but it is rarely so minute as the corresponding tooth in the upper jaw. The last upper molar is rather less in section than half the next.

The genus *Vespertilio*, as at present restricted, ranges throughout nearly all tropical and temperate regions in both hemispheres, and has consequently a wider distribution than any other genus of *Chiroptera*. The species are recognized by the narrow hairy muzzle, the long oval ear, the narrow elongate tragus, and the numerous teeth. The members of this genus are, as a whole, more susceptible to cold than those belonging to *Vesperugo*, and are consequently less numerously represented in the colder parts of the temperate zone. They also appear later in the spring after hibernation.

The species of *Vespertilio* are difficult to classify and distinguish. Those with larger feet free from the wing are said to be dwellers in caves, whilst the smaller-footed forms, with the wing-membranes from the base of the toes, live mainly in trees. But no definite line can be drawn in the case of either the characters or the habitat.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Foot large, measuring from wrist to end of claws more than ¼ length of forearm. Calcaneum extending fully ¾ the distance from ankle to tail.
  - *a.* Wings from ankles or a little above.
    - *a′*. Second premolar above and below minute, inside the tooth-row; forearm about 1·6 inches .... *V. hasselti*, p. 330.
    - *b′*. Second premolar in the tooth-row, visible from outside; forearm about 1·45.... *V. longipes*, p. 331.
  - *b.* Wings from side of foot immediately below ankle.
    - *a′*. Ears laid forward extend to end of nose; forearm about 1·45 .... *V. daubentoni*, p. 331.
    - *b′*. Ears extend beyond end of nose; forearm about 1·45 .... *V. megalopus*, p. 332.
- B. Foot moderate, less than ¼ the length of forearm. Calcaneum extending about halfway from ankle to tail.
  - *a.* Wings from side of foot, between ankle and base of toes.
    - *a′*. First upper premolar at least double second in height; forearm about 2·25 *V. murinus*, p. 334.
    - *b′*. Two anterior upper premolars subequal, both small; forearm about 2·2 ...... *V. dobsoni*, p. 335.
  - *b.* Wings from base of outer toe.
    - *a′*. Wing-membranes particoloured orange and black; forearm about 1·9 ...... *V. formosus*, p. 335.
    - *b′*. Wing-membranes the same colour throughout.
      - *a″*. No postcalcaneal lobe.
        - *α*. Terminal half of fur on lower surface white; forearm about 1·35 *V. nipalensis*, p. 333.
        - *β*. Fur of lower surface dark brown with ashy tips; forearm about 1·35 *V. mystacinus*, p. 336.
      - *b″*. A postcalcaneal lobe; forearm about 1·25 .... *V. muricola*, p. 337.

203. **Vespertilio hasselti.** *Van Hasselt's Bat.*

Vespertilio hasselti, *Temminck, Mon. Mam.* ii, p. 225, pl. lvi, figs. 7, 8 (1835–41); *Blyth, Mam. Birds Burma,* p. 23; *Dobson, Mon. As. Chir.* p. 126; *id. Cat. Chir. B. M.* p. 291.

Muzzle blunt, glandular area between the eyes and the nostrils rather tumid, and face in front of the eyes almost naked. Ears short, laid forward each extends halfway between the eye and the nostril; tips broadly rounded, the outer margin straight from near the tip to opposite the base of the tragus; there a fold of the conch enters the margin and forms a small terminal convex lobe ending in front of the inner margin, which is convex throughout. Tragus moderately long, rather bluntly pointed, inner margin straight; outer slightly convex, with a triangular lobe at the base.

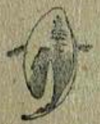

Fig. 105.—Ear of *V. hasselti.* (Dobson, Cat. Chir. B. M.)

Wings from the ankles; calcaneum very long; feet very long and slender; interfemoral membrane forming an acute angle behind. Fur very short.

The second premolar in both jaws very minute and difficult to see, even with a lens; it is, both above and below, placed in the angle between the first and third premolar.

Colour of fur greyish brown above, dirty white below; all the basal portions of the hairs dark brown on both surfaces.

Dimensions. Head and body 2·1 inches, tail 1·75, ear outside from the crown 0·45, forearm 1·6.

Distribution. Malay Peninsula, Siam, Sumatra, Java, &c. A specimen from Burma, the exact locality not recorded, is in the British Museum.

Externally this species is a *Vesperugo*, and it was long referred to that genus, of which it has the nearly naked face and short ears, whilst the second lower premolar is much more minute than in any other *Vespertilio.* That the distinction of these genera by the dentition is artificial, especially when the teeth are mere rudiments, is shown by such instances as are afforded by the present form and by *Vesperugo annectens.*

V. adversus, Horsfield (not of Temminck), has an extensive range from Siam to South Australia, and may very possibly be found in Burma; indeed it is possible that it may be the *Myotis berdmorei* of Blyth (Cat. p. 35) from Schwe Gyeng. This species was, however, so imperfectly described (J. A. S. B. xxviii, p. 293), that as the specimens have unfortunately been lost, it is now impossible to identify it, and its being referred to *Myotis* suggests that it was more probably an ally of *V. mystacinus.* The bat called *V. adversus* by Temminck, Blyth, Cantor, Jerdon, and others was *V. muricola.*

The true *V. adversus* has a foot measuring 0·48 inch, wings from the ankles, a very long calcaneum, an oval ear without emargination, a moderately long pointed tragus with the inner margin

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straight and the outer slightly convex, and an extremely small second upper premolar, quite inside the tooth-row; the second lower premolar, though small, being in the tooth-row. The coloration of the fur is very dark brown; the length of the forearm 1·5 inches.

204. **Vespertilio longipes.** *The Kashmir cave Bat.*

? Myotis theobaldi, *Blyth, J. A. S. B.* xxiv, p. 363; *id. Cat.* p. 36, note; *Jerdon, Mam.* p. 46.
Vespertilio macropus, *Dobson, P. A. S. B.* 1872, p. 209, *nec Gould.*
Vespertilio longipes, *Dobson, P. A. S. B.* 1873, p. 110; *id. Mon. As. Chir.* p. 131; *id. Cat. Chir. B. M.* p. 294; *Anderson, Cat.* p. 139; *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 269.

Crown of head considerably raised; muzzle narrow, pointed, hairy; nostrils projecting slightly, and opening sublaterally with a hollow between them. Ears extending, when laid forward, to the end of the muzzle, narrow, tapering, the tips narrowly rounded off; upper half of the outer margin concave, lower half convex, inner convex throughout. Tragus long, slender, tapering towards the tip, which is rounded off; the outer margin has two small projecting lobes near the base.

Wings from the ankles. Feet very large, the toes forming more than half the length of the foot; the first and fifth toes shorter than the others. Face very hairy, and the upper lip clothed with long straight hairs.

The first and second upper premolars are both small, the second but slightly more internal in position than the first.

Colour of fur above black, below the same with whitish tips.

Dimensions. Head and body 1·75 inches, tail 1·45, forearm 1·45, foot 0·4.

Distribution. The types were obtained at the caves of Bhima Devi, Kashmir, elevation 6000 feet.

It is probable that *Myotis theobaldi*, obtained from caves near Matur Nag, N. of Islamabad, Kashmir, was the same as *V. longipes*, for the two agree in dimensions and both are characterized by large feet; but it is impossible to identify *Myotis theobaldi*, for the types have been lost, and it was said to be extremely close to the pipistrelle, from which *V. longipes* differs considerably in structure.

205. **Vespertilio daubentoni.** *The water Bat.*

Vespertilio daubentonii, *Leisler, Kuhl, Deutsche Flederm.* p. 51, pl. xxv, fig. 2 (1817); *Dobson, Mon. As. Chir.* p. 132; *id. Cat. Chir. B. M.* p. 297.

The ears laid forward extend nearly or quite to the nostril, tips rounded, not very broadly; inner margin regularly convex from base to tip; outer margin straight or slightly concave throughout nearly the upper half, then abruptly convex. Tragus about half the length of the ear, subacutely pointed; inner margin quite straight, outer gently convex, with a distinct rounded lobe projecting just above the base.

Wings from the metatarsi; feet large; calcaneum long; last two vertebræ projecting from the interfemoral membrane. The face rather in front of the eyes half naked; glandular area between eyes and ear rather tumid.

Upper incisors subequal in size, their cusps diverging widely. Second upper premolar in the tooth-row, fully visible from without, and about one third the height of the first.

Colour brown, usually snuff-brown above, dirty white below; basal half or more of all hairs dark brown.

Dimensions. Head and body 1·9 inches, tail 1·7, ear from crown of head 0·4, forearm 1·45.

Distribution. Throughout the greater part of the Palæarctic region. This species has not been recorded from the Himalayas, but, strange to say, two specimens were obtained in Tenasserim by Mr. Limborg.

Habits. This bat in Europe is generally found near water, and, in the evening, flies about close to the surface of lakes, ponds, and rivers, and feeds upon the insects that are so common over water. It rests mainly on trees. It appears soon after sunset as a rule, and after hunting over water for a time returns to hang on a branch before it issues again in search of food.

206. **Vespertilio megalopus.** *The narrow-eared water Bat.*

Vespertilio megalopus, *Dobson, A. M. N. H.* (4) xvi, p. 261 (1875); *id. Cat. Chir. B. M.* p. 298.

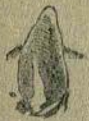

Fig. 106.—Ear of *V. megalopus.* (Dobson, Cat. Chir. B. M.)

Very similar to *V. daubentoni*, but the ears are longer, much narrower, and more acute, and laid forwards extend beyond the end of the nose; the upper third of the inner margin of the ear-conch is straight instead of being convex, and the tip is narrowly rounded off. The tragus is longer, narrower, and quite obtuse, the upper third of its inner margin slightly concave, but the extremity is not directed inwards.

Wing-membrane from just below the ankle. The first and second premolars are proportionally smaller, and the second is more inside the tooth-row than in *V. daubentoni.*

Dimensions. Head and body 1·65 inches, tail 1·6, ear from crown 0·5, forearm 1·45.

Distribution. Kashmir. The collection containing this and other species was purchased by the British Museum and supposed at the time to be African, but it has since proved to be from Kashmir. The present is one of the few species included that has not been met with in other Kashmir collections.

207. Vespertilio nipalensis. *The Nepal Bat.*

Vespertilio pallidiventris, *Hodgson, Calc. Journ. N. H.* iv, p. 286 (1844) (name only).
Vespertilio nipalensis, *Dobson, P. A. S. B.* 1871, p. 214; *id. Mon. As. Chir.* p. 141; *id. Cat. Chir. B. M.* p. 302; *Anderson, Cat.* p. 140; *Scully, J. A. S. B.* lvi, pt. 2, p. 253.

Muzzle narrow, but with distinct half-naked glandular prominences between the eyes and nostrils. Ears not extending to the nostrils when laid forward, narrow and bluntly pointed; outer margin of the ear-conch hollowed out beneath the tip, which projects outwards considerably, lower half of outer margin convex, terminating, without any lobe, in front of the base of the tragus. The tragus is long, narrow, pointed, and curved slightly outwards; a small lobule at the base of the outer margin.

Fig. 107.—Head of *Vespertilio nipalensis.* (Dobson, Mon. As. Chir.)

Wings from the base of the toes. Fur of the head and back dense and long, the long hair extending on the face to between the eyes.

The canines in both jaws very short, in the lower jaw resembling premolars; the first and second premolars are minute, and in the upper jaw scarcely distinguishable without the aid of a lens.

Colour of fur above black with brown tips; below pure white, the basal two thirds of the hair being black.

Dimensions. Head and body 1·65 inches, tail 1·35, ear from base of outer margin 0·6, forearm 1·35.

Distribution. The only specimen known, now in the Indian Museum, Calcutta, is from Katmandu, Nepal.

The above description is taken from Dobson's. I have not examined the specimen. Scully has shown that Hodgson's *V. pallidiventris* was the same species.

A bat which will probably be found hereafter in Baluchistan and Southern Afghanistan is *V. desertorum*, Dobson (see Cat. Chir. B. M. p. 304), the type of which was obtained at Jalk, within the Persian frontier, and which was subsequently classed by the describer as a subspecies or variety of the European *V. emarginatus*. *V. desertorum* is in any case an extremely well-marked race, larger than the European bat, very pale-coloured, both as regards the fur and the membranes, with very thin ears, extending when laid forward to the nostrils, and with the outer margin of the ear-conch deeply and subangularly emarginate about one third below the tip.

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The tragus is long, attenuate, and pointed. Wings from the base of the toes. Forearm 1·75 inches.

208. **Vespertilio murinus.** *The common European Bat.*

Vespertilio murinus, *L. Syst. Nat.* ed. xii, i, p. 47, partim (1766); *Schreb. Säugeth.* i, p. 165, pl. li; *Dobson, Mon. As. Chir.* p. 137; *id. Cat. Chir. B. M.* p. 309; *Anderson, Cat.* p. 141.
Vespertilio blythii, *Tomes, P. Z. S.* 1857, p. 53; *Jerdon, Mam.* p. 45; *Hutton, P. Z. S.* 1872, p. 709.
Myotis murinus, *Blyth, J. A. S. B.* xxi, p. 360; *id. Cat.* p. 35; *Jerdon, Mam.* p. 46.
Vespertilio africanus, *Dobson, A. M. N. H.* (4) xvi, p. 260 (1875); *id. Cat. Chir. B. M.* p. 310.

Crown of the head slightly raised. Muzzle blunt, area between eye and nostril somewhat tumid, the sides of the face and end of the nose above half naked, but there are some long hairs on the upper lip. Ears large, extending to just beyond the end of the muzzle when laid forward, or, in Himalayan specimens, just extending to the nostrils, the tips bluntly-pointed; inner margin of the ear-conch moderately convex to the base, where the basal lobe joins at a right angle; outer margin concave below the tip, the upper half wavy, the middle convex; there is a shallow notch opposite the base of the tragus, followed by a convex lobe terminating opposite the base of the inner margin. Tragus of moderate length, narrow, attenuate above and subacutely pointed; inner margin nearly or quite straight; outer with a small basal lobe, then convex for about half its length, becoming straight above.

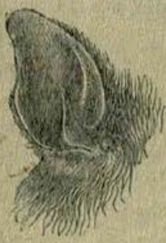

Fig. 108.—Ear of *V. murinus.* (Dobson, Mon. As. Chir.)

Wings from the metatarsi. Only the extreme tip of the tail projects from the interfemoral membrane. Basal portion of interfemoral well clad with hair above.

The first upper premolar is about half the height of the third; the second is quite small, but not minute, it is usually somewhat inside the tooth-line, in the angle between the first and third.

Colour of fur greyish to reddish brown, not dark, above, very pale brown to sullied white below, the base of the hairs dark throughout.

Dimensions. Head and body of a male from Kashmir (preserved in alcohol) 2·6 inches, tail 2·2, ear from crown 0·65, forearm 2·25. In fresh specimens, according to Hutton, the head and body measured 3 inches, tail 2½.

Distribution. The Palæarctic region generally, as far north as Southern England, Denmark, &c. This species has been found in Kashmir by Sir O. B. St. John, and at Mussoorie, in the Himalayas, by Hutton. The type of *V. blythii* was said to be from Nusseerabad, in Rajputana, but this locality I think requires confirmation.

The Kashmir variety has somewhat shorter ears, and in some cases a more pointed tragus than the normal form.

Habits. *V. murinus* appears late in the evening, and flies low and slowly. It hides during the day in caves and buildings, and hibernates in similar places in considerable numbers together. According to Hutton, it attacks and kills smaller bats when they are kept with it in confinement, and devours some of the flesh. The female has one young, which is generally found clinging to the mother from the end of May till well into July.

209. **Vespertilio dobsoni.** *The Chamba Bat.*

Vespertilio murinoides, *Dobson, J. A. S. B.* xlii, pt. 2, p. 205 (1873); *id. Mon. As. Chir.* p. 138; *id. Cat. Chir. B. M.* p. 310, *nec Lartet,* 1851.

Vespertilio dobsoni, *Trouessart, Cat. Mam.* p. 88 (1879).

"Ears slightly shorter than the head; general form of the ear-conch triangular, with narrow rounded tip; the inner margin very faintly convex, almost straight in its upper third; the outer margin concave beneath the tip; the remaining portion convex, with a faint concavity opposite the base of the tragus. The tragus is slender and acutely pointed, with a quadrangular lobe at the base of the outer margin."

"The first upper premolar is very small, scarcely visible from without, and not much larger than the second."

Colour of fur dark brown above, with light brown tips; beneath dark brown, almost black, with greyish tips.

Dimensions of an adult female:—Head and body 2·5 inches, tail 2·1, ear from base of outer margin 0·85, forearm 2·1.

Distribution. Only a single specimen is known. This was procured at Chamba (N.W. Himalaya), at an elevation of 3000 feet.

The type of this species may possibly be an aberrant individual of *V. murinus*, but the differences appear too great. The description is copied from Dobson's, as I have not examined the specimen. The name *V. murinoides* required to be changed, as it was given by Lartet in 1851 to a species found fossil in the Miocene of Sansan, France.

210. **Vespertilio formosus.** *Hodgson's Bat.*

Vespertilio formosus, *Hodgson, J. A. S. B.* iv, p. 700 (1835); *Blyth, J. A. S. B.* xx, p. 158; *Dobson, Mon. As. Chir.* p. 140; *id. Cat. Chir. B. M.* p. 311; *Anderson, Cat.* p. 142; *Scully, J. A. S. B.* lvi, pt. 2, p. 254.

Kerivoula pallida, *Blyth, Cat.* p. 34 (1863).

Murina formosa *and* Kerivoula pallida, *Jerdon, Mam.* pp. 42, 43.

Vespertilio auratus, *Dobson, J. A. S. B.* xl, pt. 2, p. 186, pl. x, figs. 1, 2 (1871).

Kerivoula formosa, *Hutton, P. Z. S.* 1872, p. 711.

Vespertilio dobsoni, *Anderson, Cat.* p. 143 (1881), *nec Trouessart,* 1879.

Face flat, hairy throughout except at the extreme end of the nose; muzzle conical, the nostrils projecting slightly beyond the upper lip, and opening sublaterally, with a shallow hollow between them. Ears scarcely extending to the nostrils when laid forward; tips rounded, directed outwards; outer margin of ear-conch concave, with a wavy outline in the upper half, then convex, and terminating opposite the base of the tragus in a small lobe folded inwards. Tragus long, narrow, obtusely pointed, inner margin straight, outer with a very small lobule at the base, then convex, becoming straight above.

Wing-membrane very broad, attached to the base of the outer toe. Fur thick and woolly. Nearly half the interfemoral membrane is thickly clad with hair above, backs of toes the same. Dentition as in *V. murinus*, the second upper premolar minute.

Colour of fur above fawn-colour to golden brown, below paler and whitish. Some specimens are tinted with rusty red. The dorsal hairs have sometimes the basal third dark brown. The membranes (including the ears) are orange with the exception of black triangular areas between the third and fourth, and fourth and fifth fingers, and inside the fifth, the fingers themselves and the membrane close to them being orange, as in *Cerivoula picta*. The black triangular areas are sometimes dotted and streaked with orange.

Dimensions. Head and body 2·4 inches, tail 1·9, ear from crown 0·55, forearm 1·9.

Distribution. Himalayas near Mussoorie up to 5500 feet, Nepal, Sikhim, Assam, Khási hills, Bengal (Calcutta, Purneah, Chybassa), and China.

V. dobsoni of Anderson appears to me to be founded on a very large individual of *V. formosus* with the forearm 2·15 inches long.

211. **Vespertilio mystacinus.** *The whiskered Bat.*

Vespertilio mystacinus, *Leisler*, *Kuhl*, *Deutsche Flederm.* p. 58 (1817); *Dobson, Mon. As. Chir.* p. 133; *id. Cat. Chir. B. M.* p. 314; *Scully, J. A. S. B.* lvi, pt. 2, p. 254.

Vespertilio siligorensis (*and* V. darjelingensis ?), *Hodgson, Horsf. A. M. N. H.* (2) xvi, p. 102 (1855); *Jerdon, Mam.* pp. 44, 45.

Crown slightly raised above the face, which is covered with long hairs throughout down to the edge of the upper lip; muzzle narrow. Ears, when laid forward, extending beyond the end of the nose, tips rounded; upper half of outer margin of ear-conch deeply concave with a wavy outline, lower half abruptly convex, with a distinct small lobe at the base. Tragus attenuate above and subacutely pointed; inner margin straight; outer with a small lobule at the base, then sloping outwards to the broadest part of the tragus, opposite about a quarter the height of the inner margin, thence, after a brief convexity, sloping upwards and inwards to the end.

Wings from the base of the toes. A slight projection from the interfemoral membrane at the end of the calcaneum. The last caudal vertebra free.

Upper incisors subequal, diverging, all bifid. The first upper premolar is twice the height of the second, and scarcely one third the height of the third; the first two slightly internal.

Colour of fur brown, more or less rufescent above, greyish below, basal portion of hairs dark brown or black throughout.

Dimensions. Head and body 1·8 inches, tail 1·55, ear from crown 0·5, forearm 1·35. These are from a Nepal specimen, European individuals as a rule are smaller.

Distribution. Throughout the greater portion of the Palæarctic region, extending to the Himalayas, where, however, this species has hitherto been found in Nepal and Sikhim only. Scully states that it is one of the commonest species in the Nepal valley.

Habits. The whiskered bat is generally found in hollow trees, wooden roofs, &c. It flies swiftly, often over water, and appears early in the evening.

212. **Vespertilio muricola.** *The mustachioed Bat.*

Vespertilio adversus, *Temminck, Mon. Mam.* ii, p. 221; *Blyth, J.A.S.B.* xxi, p. 346; *id. Cat.* p. 35; *Jerdon, Mam.* p. 45; *Hutton, P. Z. S.* 1872, p. 710; *nec Horsfield.*
Vespertilio muricola, *Hodgson, J. A. S. B.* x, p. 908 (no description); *Gray, Cat. Mam. &c. Nepal and Thibet,* 1846, p. 4; *Dobson, Mon. As. Chir.* p. 134; *id. Cat. Chir. B. M.* p. 316; *Anderson, Cat.* p. 142; *Scully, J. A. S. B.* lvi, pt. 2, p. 255.
Vespertilio caliginosus, *Tomes, P. Z. S.* 1859, p. 73; *Jerdon, Mam.* p. 44.
Vespertilio (Pternopterus) lobipes, *Peters, MB. Akad. Berl.* 1867, p. 706.
Vespertilio blanfordi, *Dobson, P. A. S. B.* 1871, p. 214.
Vespertilio moupinensis, *A. Milne-Edwards, Rech. Mam.* p. 253, pls. xxxvii A, xxxvii C.

Muzzle narrow; face covered with long hair, on the glandular area between each eye and nostril and on the upper lip the covering is thin, though the hairs are very long; only the tip of the nose is naked. The ears laid forward reach the nostrils, the tips are narrowly rounded, the inner margin of the ear-conch is straight for a third of its length below the tip, then convex, straight again towards the base, the angle of the basal lobe somewhat rounded; outer margin deeply concave with a wavy outline below the tip and for about a third of its length, then convex, slightly emarginate opposite the base of the tragus and ending in a short, distinct, convex lobe. Tragus pointed, the inner margin slightly concave, outer with a well-defined lobe at the base, then strongly convex to above the broadest part of the tragus, and thence sloping in a moderately convex curve to the end.

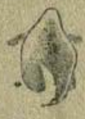

Fig. 109.—Ear of *V. muricola.* (Dobson, Cat. Chir. B. M.)

Wings from the base of the outer toe; tail not projecting beyond the interfemoral membrane. A small convex postcalcaneal lobe.

Second upper premolar slightly within the tooth-row, minute, scarcely visible without a lens.

Colour of the fur above black with pale tips; below, basal portion of the hairs black with ashy tips; membranes intensely black.

Dimensions. Head and body 1·75 inches, tail 1·5, ear from crown 0·42, forearm 1·3.

Distribution. The greater portion of the Oriental region. In the Himalayas this species has been found at Murree, Dalhousie, Simla, and Mussoorie, in Nepal, and in Sikhim, at elevations up to fully 8000 feet; also at Calcutta, in Chutia Nágpur, in Ceylon, Arakan, Tenasserim, and the Mergui Archipelago, and, outside Indian limits, in Eastern Tibet, the Malay Peninsula, Java, Sumatra, Borneo, and Celebes.

No description of this bat was given by Hodgson, and Gray's was imperfect, though it may be accepted, as a type exists in the British Museum.

Habits. According to Hutton, "this bat is early on the wing, coming out of caves and hollow trees, flying high, and is very rapid in its movements. Like *Vesperugo micropus* (*V. abramus*), when touched it opens the mouth wide, without emitting a sound, or making the least attempt to escape or bite."

Genus **CERIVOULA**, Gray (1842).

Syn. *Kerivoula*, Gray.

Muzzle narrow; skull concave between the nose and crown. Glandular region between the eye and nose small, not prominent; mouth wide, the upper lip and angle of the mouth thickly fringed with long hairs. Nostrils circular, opening sublaterally close to the margin of the upper lip. Ears with the outer margin coming forward, so as in great part to conceal the tragus when viewed from the side, and terminating abruptly in a deep lobe, not separated by a notch or concavity from the upper portion of the ear-margin, nor carried forward to near the angle of the mouth; ear-conch thin, diaphanous, studded with glandular papillæ, from which hairs arise. Tragus extremely long, narrow, and acutely pointed. Membranes of wings and interfemoral area largely developed; calcaneum long and strong, curved backwards; no postcalcaneal lobe; tail equalling or exceeding the head and body in length.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$, as in *Vespertilio*, but the upper incisors are parallel, not divergent, and the second upper premolar, though smaller than the third, is never minute.

This genus is essentially tropical, and inhabits the Oriental, Ethiopian, and Australian regions. Three species are recorded from British India and its dependencies.

CSL

Synopsis of Indian, Ceylonese, and Burmese species.

A. Wing-membranes particoloured orange and black	*C. picta*, p. 339.
B. Wing-membranes of the same colour throughout	
a. The ear, when laid forward, does not extend to the nostril; forearm 1·4	*C. hardwickii*, p. 340.
b. The ear extends to the nostril; forearm 1·7.	*C. papillosa*, p. 341.

213. **Cerivoula picta.** *The painted Bat.*

Vespertilio pictus, *Pallas, Spic. Zool.* fasc. iii, p. 7 (1767).
Kerivoula picta, *Cantor, J. A. S. B.* xv, p. 185; *Blyth, J. A. S. B.* xx, p. 158; *id. Cat.* p. 34; *Kelaart, Prod.* p. 25; *Jerdon, Mam.* p. 43; *Dobson, Mon. As. Chir.* p. 146; *id. Cat. Chir. B. M.* p. 332; *Anderson, Cat.* p. 144.

Kehel vulha, Cingalese.

Ears moderately long, reaching when laid forward to halfway between the eye and the muzzle, bluntly but distinctly pointed, broad; inner margin very convex and coming forward above the eye, terminating in a rounded basal lobe; outer margin concave just below the tip, then coming forward with a bold convex sweep and terminating abruptly midway between the base of the tragus and the angle of the mouth. Tragus very long, the outer margin without a basal lobe, but with a projecting point opposite the base of the inner margin, from this point the outer margin slopes straight upwards to the fine pointed tip; inner margin straight throughout.

Thumb short; wings from the base of the toes. Face naked in front of the eyes, and around them and the nostrils, but densely haired on the upper lip and above the middle of the nose. Hair is thinly scattered over the wing-membranes near the body, and on the upper surface of the interfemoral; the toes are densely clad, and a thick short fringe of hair extends along the posterior margin of the calcaneum and interfemoral membrane.

Inner upper incisors long and pointed, each with a basal cusp posteriorly and externally situated; outer incisors about equal in length to the basal cusps of the inner. First and second upper premolars subequal.

Colour of fur above deep orange or bright ferruginous, below yellower and paler, the hairs the same tint throughout; ears, antebrachial and interfemoral membranes deep orange; wing-membranes black with orange spots, except along both sides of each finger, the margin of the forearm, and along the body, where the colour is orange.

Dimensions. Head and body 1·5 inches, tail 1·7, forearm 1·4, ear from crown outside 0·4.

Distribution. Widely distributed in India, Ceylon, and Burma, being recorded from Sikhim, Calcutta, Dacca, Jeypore, Bombay, Madras and the Malabar coast, Ceylon, where it appears to be common, and Burma. Rare in the drier parts of India.

Habits. This very richly-coloured bat is said to be often found on plantain trees (*Musa*), and its Cingalese name, of which the generic term applied by Gray is probably a corruption, means plantain bat. When disturbed in the daytime, *C. picta* looks, as Jerdon remarks, more like a large butterfly than a bat. The brilliant coloration is shown by Swinhoe to be very similar to that of some dead leaves, and consequently to be protective.

214. **Cerivoula hardwickii.** *Hardwicke's Bat.*

Vespertilio hardwickii, *Horsfield, Res. Java* (1824).
Kerivoula hardwickii, *Dobson, Mon. As. Chir.* p. 148; *id. Cat. Chir. B. M.* p. 335; *Anderson, Cat.* p. 145.
Kerivoula fusca, *Dobson, P. A. S. B.* 1871, p. 215.

Ears a little longer than in *C. picta*, but not extending to the nostrils when laid forward; tips thoroughly rounded, inner margins regularly convex from end to end; outer margins deeply concave below the tip, then much expanded, even more so than in *C. picta*. Tragus very long and much attenuated, inner margin straight, outer with a small angular projection opposite the base of the inner margin, above this convex, the upper two thirds concave, tip pointed.

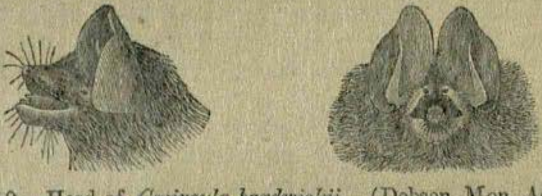

Fig. 110.—Head of *Cerivoula hardwickii*. (Dobson, Mon. As. Chir.)

Thumb large. Wings from the base of the toes. Posterior margin of interfemoral membrane finely crenulated and fringed with very few hairs. All the membranes nearly naked, the fur being almost confined to the body.

Upper inner incisors without any posterior cusp, outer incisors scarcely half the length of the inner. First upper premolar equal to the third in height, though less in section, second premolar about one third shorter.

Colour of fur greyish brown above and below, the basal half dark brown. Membranes uniformly dark.

Dimensions. Head and body 1·5 inches, tail 1·7, ear from crown outside 0·45, forearm 1·4.

Distribution. Probably throughout the greater part of the Oriental region. A specimen, now in the British Museum, was obtained by Mr. Theobald in the Punjab on the Indus, another is from Ceylon, and others are recorded from Assam and the Khási hills, as well as from Cambodia, Java, Borneo, &c.

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215. Cerivoula papillosa. *The papillose Bat.*

Vespertilio papillosus, *Temminck, Mon. Mam.* ii. p. 220 (1835–41).
Kerivoula papillosa, *Tomes, P. Z. S.* 1858, p. 327; *Jerdon, Mam.* p. 43; *Dobson, Mon. As. Chir.* p. 150; *id. Cat. Chir. B. M.* p. 337.

Ears very similar to those of *C. hardwickii* but longer, extending to the end of the muzzle, and the outer margins do not project so much in front. A dense fringe of hair on the upper lip. Wings from the base of the claws; thumbs and feet large and armed with large and strong claws. Dentition as in *C. hardwickii*, but upper incisors shorter.

Colour of fur on back glossy brown, head and lower parts paler and greyer, basal two thirds of the hair dark brown throughout.

Dimensions. Head and body 2·2 inches, tail 2·2, forearm 1·7.

Distribution. A specimen was sent from Calcutta by Mr. Pearson, and is now in the British Museum. Tomes also records one from Ceylon, but the identification is less certain, nor is it absolutely proved that the first specimen was Indian, though this is probable. The only other known localities are Java and Sumatra.

This species is easily distinguished from *C. hardwickii* by its much larger size and by its colour.

There is another species, *C. brunnea*, Dobson, Cat. Chir. B. M. p. 334, closely resembling *C. picta* in size and structure, but with the membranes dark brown, the fur yellowish brown above, greyish brown below, all the basal portion of the hair dark brown, and the upper incisors nearly equal in size. The type of this was presented by Sir A. Smith to the British Museum, and it is quite uncertain whether the specimen came from Madras or South Africa.

Genus **MINIOPTERUS**, Bonaparte (1837).

Crown of the head much raised above the face-line. Ears separate, short, rounded, the outer margin terminating just behind the angle of the mouth; tragus as in *Vesperugo*, of moderate length, blunt, not attenuated above. Nostrils not tubular, crescentic. Muzzle broad; the median portion of the upper lip

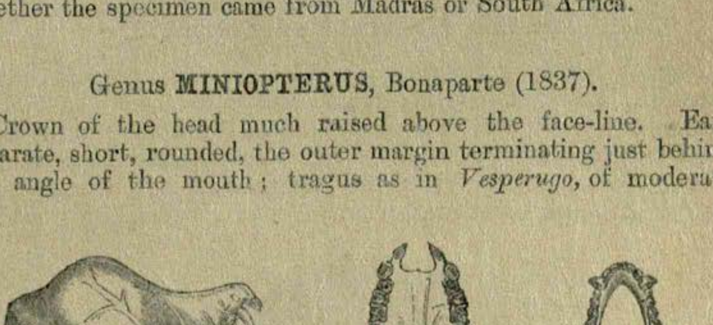

Fig. 111.—Skull of *Miniopterus schreibersi*, × 2. (Blasius, Säugeth. Deutschlands.)

below the nose forming a kind of depression sharply divided on each side from the more swollen lateral portions of the lip. The first phalanx (middle joint) of the third or longest finger very short, less than one third the length of the second or terminal phalanx, which is very long, and is folded in repose on the under surface of the wing, reaching beyond the middle of the metacarpal bone. The wings are attached to the inferior surface of the tibia just above the ankle, and connected with the interfemoral membrane by a band of integument passing below the tibia. Tail as long as the head and body, entirely contained within the interfemoral membrane.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{3-3}$, m. $\frac{3-3}{3-3}$.

But a single representative is found in India. This has the same range as the genus and almost the widest range of any species in the Order, being found in Southern Europe, Asia, Africa, Madagascar, and Australia.

216. **Miniopterus schreibersi.** *The long-winged Bat.*

Vespertilio schreibersii, *Natterer, Kuhl, Deutsche Flederm.* p. 41 (1817).
Vespertilio fuliginosa, *Hodgson, J. A. S. B.* iv, p. 700 (1835).
Scotophilus fuliginosus, *Jerdon, Mam.* p. 36 (description incorrect).
Miniopterus australis, *Dobson, J. A. S. B.* xl, pt. 2, p. 265, *nec Tomes.*
Miniopterus blepotis, *Temm., Hutton, P. Z. S.* 1872, p. 709.
Miniopterus schreibersii, *Dobson, Mon. As. Chir.* p. 160; *id. Cat. Chir. B. M.* p. 348; *Anderson, Cat.* p. 145; *Scully, J. A. S. B.* lvi, pt. 2, p. 256.
Miniopterus pusillus, *Dobson, Mon. As. Chir.* p. 162.

Muzzle short; glandular area between the eye and nostril extending to the upper lip, prominent, thinly clad, but bearing rather long hairs; forehead thickly clothed with long hair. Ears of a subtrigonally rounded form, only extending, when laid forwards, to just beyond the eyes; tips indistinct, blunt; inner margin of the ear-conch very convex, outer margin deeply notched opposite the base of the tragus and ending in a long convex lobe that extends from the base of the tragus to the angle of the mouth. Tragus rounded above, and with the margins nearly

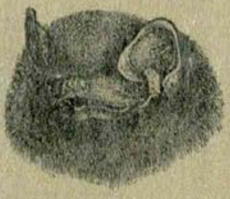

Fig. 112.—Head of *Miniopterus schreibersi.* (Blasius, Säugeth. Deutschlands.)

parallel, the inner concave, the outer convex and without any distinct lobule at the base.

Wings to the ankles or rather higher. Fur soft, dense, and long.

Colour in Indian specimens generally dark brown, varying from reddish to blackish brown above, the hairs of the same colour throughout; below rather paler and greyer, with the basal portion of the fur dark. European and North-African specimens are grey, with the membranes pale and whitish, and similar individuals may be expected to occur in Baluchistan.

Dimensions. Head and body 2·3 inches, tail 2·3, ear from crown of head 0·25, forearm 1·9. In Burmese specimens the forearm is as much as 2 inches, in Ceylon no more than 1·75, and in the variety *pusillus* only 1·6.

Distribution. Throughout Southern Europe, Southern (and great part of Central) Asia, Africa, Madagascar, and Australia. This species does not appear to be common in India: it has been recorded from Mussoorie in the Himalayas, at 2000 to 7000 feet, also from Nepal, Ceylon, and Upper Burma, and the smaller variety *pusillus* from Madras and the Andaman and Nicobar Islands.

Varieties. The small variety just mentioned was at first referred by Dobson to *M. australis*, a small species with the interfemoral membrane half covered with hair above, but subsequently regarded as a variety or subspecies of *M. schreibersi*, a view in which I agree, as the differences do not appear to me specific. There is a little more hair on the interfemoral membrane, but Himalayan specimens show an intermediate phase.

Habits. The long-winged bat is one of the swiftest fliers in the Order, according to Blasius it almost resembles a swallow in its powerful flight and graceful movements on the wing. It appears early in the evening. During the day it hides in caves, crevices in rocks, and similar retreats, such as old buildings, tombs, &c. Hutton states that he never met with a specimen that was not infested with ticks.

Family EMBALLONURIDÆ.

No nose-leaf. Ears often united; a tragus present, though it is sometimes very small; it is frequently expanded above. Two phalanges in the middle finger, besides the metacarpal bone, the first phalange folded in repose on the upper surface of the metacarpal *. Tail partially free, either perforating the interfemoral membrane and appearing upon its upper surface, or else produced far beyond its posterior margin.

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* There are some exceptions, but not in India. In *Rhinopoma* the folding is less complete than in other Indian genera.

The number of teeth varies. The muzzle is usually obliquely truncated, and projects more or less beyond the lower lip.

This family, which is generally distributed throughout the tropical and subtropical regions of the world, is represented in India, Ceylon, and Burma by the following four genera, classed in two subfamilies :—

I. Tail emerging from the upper surface of the interfemoral membrane, legs long, fibulæ very slender; upper incisors weak........	*Emballonurinæ.*
A. Tail shorter than interfemoral membrane; index finger formed by metacarpal alone.	
a. Incisors $\frac{2-2}{6}$, upper incisors persistent . .	EMBALLONURA.
b. Incisors $\frac{1-1}{4}$, upper incisors deciduous . .	TAPHOZOUS.
B. Tail very slender, much longer than short interfemoral membrane; index finger with a metacarpal bone and two phalanges	RHINOPOMA.
II. Tail thicker than the thigh and produced far beyond the interfemoral membrane, which it leaves at posterior margin; legs short and stout; upper incisors strong....	*Molossinæ.*
A. Upper lip much wrinkled vertically	NYCTINOMUS.

Subfamily EMBALLONURINÆ.

Genus **EMBALLONURA**, Temm. (1838).

Ears arising separately from the sides of the forehead; the outer margin of the ear-conch terminating below the eye and behind the angle of the mouth; tragus longer than broad. Forehead flat, not concave. Apertures of the nostrils circular or elliptical, close together at the extremity of the conical muzzle. Tail perforating the large interfemoral membrane about its centre and the tip appearing free on the upper surface; the posterior free margin of the membrane supported by long calcanea.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Upper incisors in pairs, separated from the canines and from each other.

This genus is entirely oceanic, ranging from Madagascar to the islands of Polynesia; no species has yet been found on the continent of Asia or in Australia, but one has been met with in the Mergui Archipelago.

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217. Emballonura semicaudata. *The Polynesian sheath-tailed Bat.*

Vespertilio semicaudatus, *Peale, U. S. Expl. Exp., Quad.* p. 23 (1848).
Emballonura semicaudata, *Dobson, Cat. Chir. B. M.* p. 360.

The extremity of the narrow muzzle projects beyond the upper lip; nostrils circular, with a shallow concavity between; lower lip crossed in the middle by a furrow, which expands above. Sides of the face and the whole muzzle in front of the eyes half-naked; some long hairs on the upper lip; forehead thickly covered with long hair. The ears do not extend to the nostrils when laid forward, the tips are narrowly rounded off; outer margin of the ear-conch concave below the tip, slightly emarginate below the base of the tragus, and terminating in a short convex lobe; inner margin straight above, slightly convex below. Tragus almost squarely truncated above, both margins nearly straight and subparallel, the inner slightly concave, the outer convex near the end, and having a small indistinct lobe folded on itself opposite the base of the inner margin.

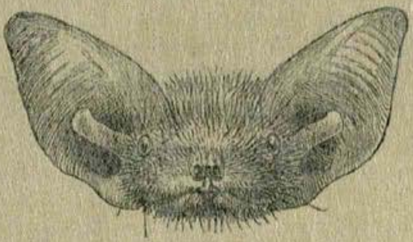

Fig. 113.—Head of *Emballonura semicaudata.*

Wings from the ankles. Tail very slender, only the tip projects above the middle of the large interfemoral membrane. Fur long and short, but not dense.

Colour of fur reddish to blackish brown, rather paler below; the hairs a little paler towards the base.

Dimensions of a male from the Mergui Archipelago in spirit:—Head and body 1·65, tail 0·5, ear from crown of head 0·42, forearm 1·75.

Distribution. This species until lately had only been found in the islands of the Pacific, especially in the Fiji Islands. Recently a specimen was received at the British Museum from Sarawak in Borneo, and Dr. Anderson has found the same bat in the Mergui Archipelago.

Genus TAPHOZOUS, Geoffroy (1813).

Muzzle conical, broad behind, narrow in front, terminated by the slightly projecting inner margins of the nostrils, which are valvular and circular or elongate. Crown of head slightly raised, in

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front of it there is a deep frontal hollow between the eyes. Ears separate and of moderate length; varying but little in shape in the different species; the tips are bluntly pointed or rounded; the inner margin of the ear-conch rises as a low band from between the eye and the frontal hollow, and is straight or slightly convex, and the outer margin is faintly notched opposite the base of the tragus and ends in a convex lobe, terminating behind the angle of the mouth, and halfway between it and the base of the tragus. The tragus is short and shaped like half a dumbbell, the upper termination expanded and convex, the sides concave. The lower lip is as long as the upper and terminated by a triangular naked area more or less deeply furrowed in the middle.

The tail perforates the interfemoral membrane about the middle, and the last three or four vertebræ are usually found extending free beyond, but they are capable of being partially withdrawn as if into a sheath.

Dentition: i. $\frac{1-1}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. The premaxillaries are cartilaginous, and the upper incisors are minute and are generally wanting in adult animals. The upper canines are closer together than in most bats and separated from the second premolar on each side by a space, in the middle of which the small first premolar is seen, only just appearing above the gum. Second upper premolar higher than the molars. Last upper molar very small. Lower incisors tricuspid, overlapping slightly.

Several of the species have a glandular gular sac, in some cases confined to the male, in others occurring in both sexes, between the rami of the lower jaw, occupying about half the space. In many of the species also a small band of membrane passes from the inferior surface of the forearm near its distal extremity to the proximal extremity of the fifth metacarpal bone, so as to form with the wing-membrane a small pouch termed by Dobson the *radio-metacarpal pouch*.

The genus ranges throughout the greater portion of the Ethiopian, Oriental, and Australian regions, and the southernmost part of the Palæarctic. Five species occur within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

- *a*. A radio-metacarpal pouch present; lower lip scarcely grooved.
  - *a'*. No gular sac in either sex.
    - *a''*. Fur of back extending on to base of interfemoral membrane; forearm 2·5. *T. melanopogon*, p. 347.
    - *b''*. Interfemoral membrane quite naked.
      - *a'''*. The abdomen hairy throughout; forearm 3 . . . . *T. theobaldi*, p. 348.
      - *b'''*. The lower abdomen naked; forearm 2·95 . . . . *T. kachhensis*, p. 349.
  - *b'*. A gular sac present in males, rudimentary but represented by a naked area in

females; interfemoral hairy to the exsertion of the tail; forearm 2·4	*T. longimanus*, p. 348.
b. No radio-metacarpal pouch; lower lip with a deep median transverse groove; gular sac in both sexes; forearm 2·9	*T. saccolæmus*, p. 350.

218. **Taphozous melanopogon.** *The black-bearded sheath-tailed Bat.*

Taphozous melanopogon, *Temminck, Mon. Mam.* ii, p. 287, p. 60, figs. 8, 9 (1835–41); *Cantor, J. A. S. B.* xv, p. 180; *Jerdon, Mam.* p. 31; *Dobson, P. Z. S.* 1875, p. 548; *id. Mon. As. Chir.* p. 167; *id. Cat. Chir. B. M.* p. 380; *Anderson, Cat.* p. 146.

No gular pouch; throat always hairy. Radio-metacarpal pouch extending about one-fourth the length of the fifth metacarpal bone. A row of small papillæ on the inner margin of the ear. Thick hair covers the forehead to between the eyes, remainder of the face and the sides of the head very thinly clad with short hairs.

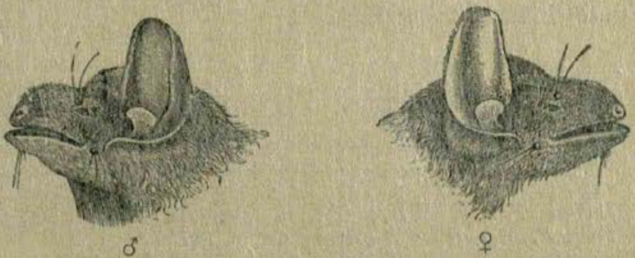

Fig. 114.—Head of *Taphozous melanopogon*, male and female. (Dobson, P. Z. S. 1875.)

Wings from the tibiæ above the ankles. The fur extends about one-third down the upper surface of the humerus and femur and very slightly upon the membrane between them. The interfemoral is thinly covered almost as far as the point where the tail perforates it.

Colour of the fur smoky brown to greyish brown, the basal portion white. There is not much difference between the upper and lower surfaces. Some specimens are blackish brown. In males there is sometimes a large patch of long black hairs on the throat (fig. 114), but this character, from which the species has been named, is not always present and may, as Dobson suggests, be assumed at the breeding-season.

Dimensions. Head and body 3·1 inches, tail 1, ear from crown 0·55, forearm 2·5.

Distribution. Probably throughout the greater part of the Oriental region. Recorded from Lower Bengal, Chutia Nagpur, Sambalpur, Canara (Malabar Coast), Trichinopoly, Upper Burma, and Tenasserim; also from Cochin China, Java, Borneo, and the Philippine Islands.

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219. **Taphozous theobaldi.** *Theobald's sheath-tailed Bat.*

Taphozous theobaldi, *Dobson, P. A. S. B.* 1872, p. 152; *id. P. Z. S.* 1875, p. 550; *id. Mon. As. Chir.* p. 168; *id. Cat. Chir. B. M.* p. 381; *Anderson, Cat.* p. 147.

No gular pouch. Ears larger than in any other species, the inner margins papillate. Radio-metacarpal pouch larger even than in *T. melanopogon.* No black beard has been observed.

The wing and interfemoral membranes are quite naked above; the limit of the body-fur in the lumbar region is defined by a well-marked line convex inwards (in *T. melanopogon* and *T. nudiventris* the convexity is outwards). In other respects, except size, this species does not appear to differ from *T. melanopogon.*

Dimensions. Head and body 3·35 inches, tail 1·35, ear from base of outer margin 1·1, forearm 3.

Distribution. Tenasserim. One specimen from Bushire, Persian Gulf, is identified with the species in Anderson's Catalogue.

I have been unable to examine a specimen, and the above description is taken from Dobson's.

220. **Taphozous longimanus.** *The long-armed sheath-tailed Bat.*

Taphozous longimanus, *Hardwicke, Tr. L. S.* xiv, p. 525 (1823); *Blyth, J. A. S. B.* x, p. 974, xiii, p. 490, xx, p. 156, xxi, p. 348, xxii, p. 414, xxiv, p. 711; *id. Cat.* p. 29; *Jerdon, Mam.* p. 31; *Dobson, P. Z. S.* 1875, p. 551; *id. Mon. As. Chir.* p. 170; *id. Cat Chir. B. M.* p. 384; *Anderson, Cat.* p. 147.

Taphozous fulvidus *and* T. brevicaudus, *Blyth, J. A. S. B.* x, pp. 975, 976.

Taphozous cantori, *Blyth, J. A. S. B.* xi, p. 784.

Taphozous longimanus *and* T. brevicaudus, *Kelaart, Prod.* p. 12.

A well-developed gular sac in males, in females it is represented by a fold of the skin and the absence of hair in the area between the fold and the chin. Radio-metacarpal pouch moderately large. Inner margin of ear smooth, not papillate.

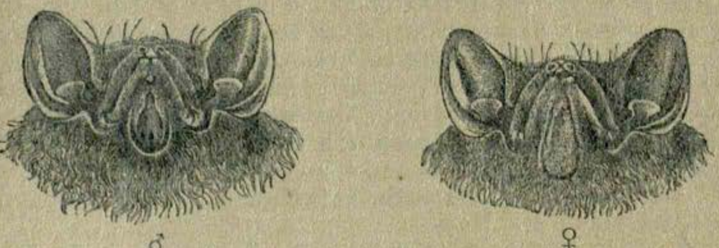

Fig. 115.—Head of *Taphozous longimanus*, male and female. (Dobson, P. Z. S.)

Wings from the tibiæ just above the ankles. On the upper surface of the wing-membrane the hair extends as far as a line joining the middle of the humerus with that of the femur; on the

GSL

interfemoral as far as the point of exsertion of the tail; a few scattered long hairs on the free part of the tail itself. The hair extends farther on the wing-membrane below than above, whilst the interfemoral is almost naked on its lower surface. Muzzle almost naked.

The upper incisors are generally absent, in young individuals they are small and slender.

Colour of fur reddish brown to black, nearly the same above and below; the hairs paler, often whitish at the base. Blyth observed that young individuals are pale fulvescent and that they grow gradually blacker with age.

Dimensions. Head and body 3 inches, tail 1·1, ear from crown 0·5, forearm 2·4.

Distribution. Thoughout the greater part of the Indian Peninsula, Ceylon, and Burma, extending to Tenasserim and Malacca; common about Calcutta (whence originally described), Madras, and other large towns. Not yet recorded from Northern or North-western India, but found in parts of the Southern Central Provinces (Chánda, Bilaspur); also near Bombay and Travancore.

Habits. This species is probably a cave-dweller and inhabitant of rock-fissures; it is frequently found in old temples, cellars, outhouses, &c. It was, however, once observed by Blyth on the stem of a palm-tree. The same observer noticed that individuals in confinement could cling to the vertical smooth mahogany back of a cage, and creep up it by means of their claws. In pregnant females a single young one was found early in August in Calcutta.

221. **Taphozous cachhensis.** *The Cutch sheath-tailed Bat.*

Taphozous kachhensis, *Dobson, P. A. S. B.* 1872, p. 152; *id. J. A. S. B.* xli, pt. 2, p. 221.

Taphozous nudiventris subsp. kachhensis, *Dobson, P. Z. S.* 1875, p. 554; *id. Mon. As. Chir.* p. 172; *id. Cat. Chir. B. M.* p. 388; *Anderson, Cat.* p. 148.

No gular sac, but its position is slightly indicated in males, not in females. Radio-metacarpal pouch small. Ear-conch with papillæ on the inner margin.

Wings from the tibiæ above the ankles. The muzzle is nearly naked. The wing and interfemoral membranes are quite naked above, as are the arms and legs, the hair terminates abruptly on the lower part of the back. Beneath, the proximal portion of the humerus and the wing-membrane as far as a line from the middle of the humerus to the pubis are hairy, but the lower abdomen, legs, and interfemoral membrane are quite naked. There are large deposits of fat about the root of the tail.

Colour not recorded, probably greyish brown as in *T. nudiventris.*

Dimensions. Head and body in a female 3·6 inches, tail 1·25, forearm 2·95; in a male 3·35, 1·15, and 2·65. The ear from the base of the outer margin measures 0·9.

Distribution. Sind and Cutch. This species is closely allied to *T. nudiventris* of Africa and South-western Asia, only differing in the want of a gular sac in the male and to some extent in measurement. In his last works Dobson has classed the present form as a variety of *T. nudiventris*, and it is very probable that the two are not specifically distinguishable.

222. **Taphozous saccolæmus.** *The pouch-bearing sheath-tailed Bat.*

Taphozous saccolaimus, *Temm. Mon. Mam.* ii, p. 285, pl. 60, figs. 1–6 (1835–41); *Cantor, J. A. S. B.* xv, p. 180; *Blyth, J. A. S. B.* xxi, p. 348; *id. Cat.* p. 28; *Jerdon, Mam.* p. 32; *Dobson, P. Z. S.* 1875, p. 555; *id. Mon. As. Chir.* p. 172; *id. Cat. Chir. B. M.* p. 388; *Anderson, Cat.* p. 149.
Taphozous crassus, *Blyth, J. A. S. B.* xiii, p. 491.
Taphozous pulcher, *Elliot, ib.* p. 492.

Ears short. Gular sac well developed in both sexes, but much larger in the male. No radio-metacarpal pouch. Inner margin of ear-conch smooth. Lower lip with a deep transverse median groove.

Wings from the ankles. The muzzle, including the eyes and the sides of the head, nearly naked. The tragus is hairy posteriorly, and there is some short hair on the inner surface of the ear-conch. Above, the fur extends on to the proximal half of the humerus, but the wing-membrane, the interfemoral, and the legs are naked; there are a few isolated long hairs on the free portion of the tail. Beneath, the wing-membrane near the body is hairy, the interfemoral naked except at the base of the tail.

Colour of fur various shades of brown—pale, ferruginous, and blackish, in some cases mottled with spots of white, the hairs paler at the base. The lower surface scarcely paler as a rule, though Blyth describes a form from Southern India said to be white beneath, like the Malayan *T. affinis.*

Dimensions. Head and body 3·5, tail 1·3, ear from crown 0·48, forearm 2·9 inches. Some specimens are smaller; in one I find the forearm only 2·5 inches long.

Distribution. Peninsula of India (Mirzapur, Madras), Ceylon, Sylhet, Burma, the Malay Peninsula, Sumatra, and Java. Remains of this species have been found fossil in the Pleistocene cave-deposits of Kurnool in the Madras Presidency.

Habits. This, like other species of the genus, inhabits caves and masonry buildings during the day. Like them, too, it has a very disagreeable smell. It is said to utter a very shrill cry.

Genus RHINOPOMA, Geoffroy (1813).

Crown of head convex, not greatly raised; a deep frontal hollow; ears with their inner margins united by a band across the hollow; tragus of moderate size. Muzzle thick, obliquely truncated, projecting considerably beyond the lower lip; nostrils placed some

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distance above the lip, in the front surface of the muzzle, they are valvular and open with a narrow transverse slit. Index finger with two phalanges besides the metacarpal bone; the third or longest finger with the first phalanx bent upwards in repose, but not resting on the dorsal surface of the metacarpal, being prevented by the great length of the index finger. Tail very long and slender, produced far beyond the posterior border of the short interfemoral membrane.

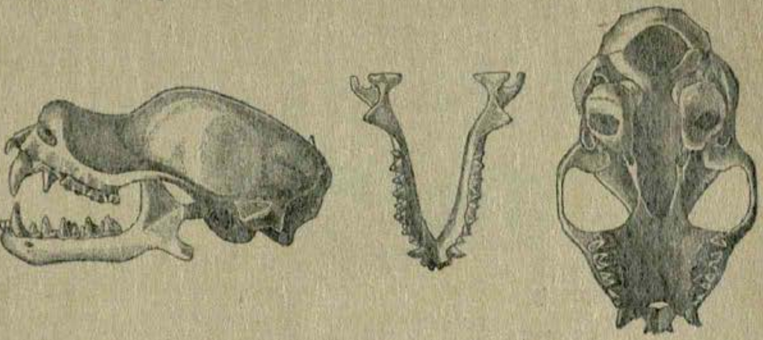

Fig. 116.—Skull of *Rhinopoma microphyllum*, × 2. (Dobson, Mon. As. Chir.)

Dentition: i. $\frac{1-1}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{1-1}{2-2}$, m. $\frac{3-3}{3-3}$. Upper incisors rudimentary. The small premaxillary bones are united in the middle, and connected by curved lateral processes with the maxillary bones. Nasal bones much expanded laterally and vertically; frontal bones depressed, forming a shallow concavity in the forehead.

This genus contains a single species ranging from Egypt and Kordofan to the Malay Peninsula.

223. **Rhinopoma microphyllum.** *The long-tailed Bat.*

Rhinopoma microphyllus, *Geoffroy, Descr. de l'Egypte, Hist. Nat.* ii, p. 123 (1813); *Blyth, J. A. S. B.* xiii, p. 492.

Rhinopoma hardwickii, *Gray, Zool. Misc.* p. 37; *Cantor, J. A. S. B.* xv, p. 178; *Elliot, Mad. Jour. L. S.* x, p. 97; *Blyth, Cat.* p. 28; *Jerdon, Mam.* p. 29; *Dobson, J. A. S. B.* xli, pt. 2, p. 221.

Rhinopoma microphyllum, subsp. hardwickii, *Dobson, Mon. As. Chir.* p. 176.

Rhinopoma microphyllum, *Dobson, Cat. Chir. B. M.* p. 400; *Anderson, Cat.* p. 149.

From the frontal hollow crossed by the band connecting the ears a deep furrow leads to the nose and terminates behind the fleshy prominence that forms the upper part of the truncated muzzle. The bluntly pointed tips of the ears laid forwards just extend to the edge of the muzzle; the margins of the ear-conch are convex, the outer terminating behind the angle of the mouth just in front of the base of the tragus. The tragus is much longer than wide, the tip very obtuse, outer margin slightly convex with a lobe at the base, inner margin forming an ogee curve, the concavity above.

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Face almost naked; no fur on the wing-membrane or the interfemoral; the lower portions of the back and abdomen and the legs are also naked.

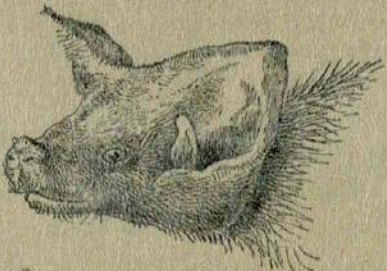

Fig. 117.—Head of *Rhinopoma microphyllum.*

Colour of fur dull greyish brown, nearly the same above and below; the hairs paler at the base.

Dimensions. An adult male measures: head and body 3 inches, tail 2·35, ear from crown 0·6, forearm 2·6. But many specimens are considerably smaller, with a forearm 2·1 or even less.

Distribution. Egypt and Kordofan in Africa; South-eastern Asia, India generally, Burma and the Malay Peninsula. Not recorded from the Himalayas or Ceylon.

Habits. This species is common in North-western India, and hides during the day in caves, clefts in rocks, old ruins, and similar places. In Cutch it takes up its abode in wells. Jerdon relates that in Madras, in 1848, many were captured in a house for three successive nights, having probably been blown by strong westerly winds from the rocky hills to the westward. The species is not of common occurrence in Madras. According to Blyth this species abounded formerly in the Táj at Agra (it may still be found there), and Cantor found numbers inhabiting the subterranean Hindu place of worship within the Fort at Allahabad.

This species may be distinguished from all other bats by the very long slender free tail. In the cold season there is an enormous accumulation of fat, sometimes exceeding the remainder of the body in weight, under the skin below the anus. The fleshy point above the truncated muzzle is sometimes called a nose-leaf, but incorrectly.

Subfamily MOLOSSINÆ.

This subfamily includes the genera of *Emballonuridæ* with short and strong legs and feet and well-developed fibulæ. All have callosities at the base of the thumbs, and the feet free from the wing-membrane, whilst the interfemoral membrane is partially retractile. The species of this subfamily are thus evidently better fitted than any other bats for terrestrial progression, and the habits

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of the few species on which observations have been made agree with their structure.

The majority of the species are American: one genus, *Mystacina*, is peculiar to New Zealand; another, *Chiromeles*, with a single species *C. torquatus*, a large bat almost entirely naked, is found in the Malay Peninsula and islands and may very possibly inhabit Tenasserim; whilst the only species yet recorded within Indian limits are two forms of *Nyctinomus*.

Genus **NYCTINOMUS**, Geoffroy (1813).

Syn. *Dinops*, Savi; *Dysopes*, Rüppell *nec* Illiger.

Muzzle thick, obliquely truncated, projecting considerably beyond the lower jaw; nostrils circular or subcircular, directed outwards, forwards and downwards, with slightly projecting margins. Upper lip very thick and vertically wrinkled. Ears thick, large and broad, more or less united on the forehead in front of the eyes; a straight thickened basal lobe inside the ear-conch. Tragus small, subquadrate. Basal portion of the tail as thick as the thigh. Legs very short; feet broad, each outer and inner toe thickened on its exterior side by a lateral pad, furnished with a dense tuft of long curly hair. Middle finger much lengthened, its metacarpal bone equal to the whole length of the fifth finger, its first phalanx folded backwards in repose. A well-marked callosity at the base of the thumb.

Dentition: i. $\frac{2}{6}$ or $\frac{2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. A few species, not Indian, have pm. $\frac{1-1}{2-2}$.

The interfemoral membrane, as in all allied genera, forms a sheath to the base of the tail and can be moved up or down the latter, thus increasing or diminishing the membranous surface.

The genus *Nyctinomus* is found in the warmer parts of both hemispheres, one species occurring in Southern Europe.

Synopsis of Indian and Burmese species.

Ears not quite united at base; about half the tail free	*N. tragatus*, p. 353.
Ears united at base; more than half the tail free . .	*N. plicatus*, p. 354.

224. **Nyctinomus tragatus.** *Dobson's wrinkled-lipped Bat.*

Nyctinomus tragatus, *Dobson, J. A. S. B.* xliii, pt. 2, p. 143; *id. Mon. As. Chir.* p. 181; *id. Cat. Chir. B. M.* p. 424; *Anderson, Cat.* p. 150.

Ears arising close together from the anterior part of the forehead, but not joined by a band; they extend when laid forward to the extremity of the muzzle or a little beyond it; upper portion of the ear-conch regularly convex, almost semicircular; outer margin separated from the terminal lobe or antitragus by a deep notch.

From inside the inner margin a thick prominent basal lobe runs directly across the inside of the conch and covers the eye. Tragus small, subquadrate, convex above.

Thumb short with a small claw. Wings from just above the ankles. Calcaneum elongate, extending nearly three quarters of the distance from ankle to tail. Only about half the tail extends beyond the end of the membrane.

Lower incisors 6, the median pair smaller and shorter than the others. Upper incisors nearer to each other than to the canine on each side. The first upper premolar very small.

The face and ears nearly naked; proximal portions of upper arms and thighs and the wing-membrane close to the body hairy. The interfemoral membrane only hairy near the base of the tail. Some long hairs on the toes.

Colour of fur greyish to blackish brown, nearly the same above and below; basal portion of hairs paler.

Dimensions. Head and body 2·9 inches, tail 1·75, forearm 2, tibia 0·6, ear from crown of head 0·6.

Distribution. Specimens have been obtained from Rajanpur (S.W. Punjab), Nasirabad (Rajputana), Malabar, Jashpur (Chutia Nágpur), and Calcutta; so this form, although not common, has evidently a wide range in the Peninsula of India.

225. **Nyctinomus plicatus.** *The Indian wrinkled-lipped Bat.*

Vespertilio plicatus, *Buchanan, Tr. L. S.* v, p. 261, pl. 13 (1800); *Geoffr. Descr. de l'Egypte, Hist. Nat.* ii, p. 130 (1813).
Nyctinomus tenuis, *Horsfield, Zool. Res. Java*; *Cantor, J. A. S. B.* xv, p. 179.
Dysopes murinus, *Gray & Hardwicke, Ill. Ind. Zool.* vol. i, pl. i.
Dysopus plicatus, *Blyth, J. A. S. B.* xx, p. 517, xxii, p. 410, xxv, p. 440.
Nyctinomus plicatus, *Blyth, Cat.* p. 29; *Jerdon, Mam.* p. 33; *Dobson, Mon. As. Chir.* p. 182; *id. Cat. Chir. B. M.* p. 425; *Anderson, Cat.* p. 151.

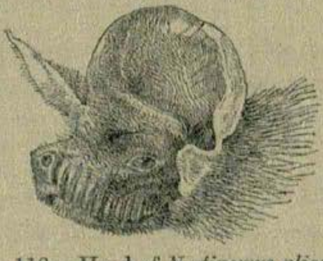

Fig. 118.—Head of *Nyctinomus plicatus.*

Ears distinctly joined by a band connecting their inner margins on the muzzle about halfway between the eyes and the end of the nose. They are large, though barely extending to the nostrils when laid forward, subtrapezoidal, upper margin not regularly convex; outer margin separated from the antitragus or terminal lobe by a deep notch. The thickened horizontal basal lobe commences some distance inside the inner margin, and extends nearly across the ear-conch inside, covering the eye. Tragus very small, subtriangular, truncated above. Muzzle broad, lips very thick, the upper overhanging the lower, both wrinkled, but the upper more so.

Wings from tibia, the point of junction varying. Calcaneum short, scarcely extending half the distance from the ankle to the tail. The free portion of the tail longer than that contained in the membrane. Distribution of the fur as in *N. tragatus*.

Lower incisors 4, first upper premolar small.

Colour of fur brownish black to greyish brown above, sometimes the same but generally paler below, basal portion of the hair lighter in colour.

Dimensions of an adult male: head and body 2·7 inches, tail 1·55, forearm 1·95, tibia 0·65, ear from crown 0·5.

Distribution. Generally distributed throughout India, Burma, and the Malay countries, but not recorded from Ceylon or the Himalayas.

Habits. This bat is found during the day in caves, deserted masonry buildings, &c. Tickell met with it in countless myriads inhabiting limestone caves at Phagat, 30 miles from Moulmain. It has, like others of the genus, a steady powerful flight high in the air, effected by sweeps of its long narrow wings. An allied species, *N. cestoni*, has the power of sinking its eye in the socket and thrusting it out again.

Two other species of *Nyctinomus*, *N. mops* and *N. johorensis*, are found in the Malay Peninsula and islands, as is also *Chiromeles torquatus*, already mentioned.

Order RODENTIA.

The Orders hitherto noticed follow each other in fairly natural sequence. The Rodents, comprising squirrels, marmots, rats and mice, jerboas, porcupines, hares and their allies, have no connexion with the Chiroptera, and but little with any other order of mammals. Like the Insectivora and Chiroptera, the Rodentia are mostly animals of small size.

Rodents can be readily distinguished by their dentition. There are no canines, and there are always two large, chisel-shaped rootless incisors, with the anterior surface curved, in front of each jaw. There are never more than two incisors in the lower jaw; in the upper there are, in one suborder, additional small incisors behind the anterior pair, not at the side of them as usual. The large incisors, or "rodent tusks" as they are sometimes termed, grow throughout the lifetime of the animals, and have long basal portions extending into deep alveoli. The incisors are widely separated from the grinding-teeth. Premolars may be present or absent. There are almost always three true molars in each side of each jaw; the crowns of these molars are in most cases tubercular, and, when worn, traversed by laminæ of enamel.

The most important character of the skull is the large size of the premaxillary bones, which contain the elongate basal portions of the upper incisors, and completely separate the nasals from the maxillaries. The orbits are never circumscribed by bone, and post-orbital processes are generally wanting. A zygomatic arch is always present. The condyle of the mandible is longitudinal, so that the lower jaw works backwards and forwards.

The mouth is divided into an anterior cavity containing the incisors, and a posterior cavity containing the molars, the two connected by a constricted orifice, lined partially or wholly by the hairy integument of the face. The feet are plantigrade, or semi-plantigrade, usually pentadactyle, and unguiculate. The intestine has a large cæcum (except in *Myoxidæ*); the uterus is double or two-horned, and the placenta discoidal and deciduate. In many families the females have an elongated perforate clitoris in front of the genital orifice, and may easily be mistaken for males. The testes in most rodents (not in the *Duplicidentata*) are retained in the abdomen, except in the rutting-season, when they become greatly enlarged. The cerebral hemispheres are smooth and do not extend back over any part of the cerebellum.

Rodents are cosmopolitan in distribution, and comprise more species than any other Mammalian order. Nearly all are exclusively

GSL

vegetable feeders. They are divided into two suborders, thus distinguished :—

Two incisors in upper jaw	SIMPLICIDENTATA.
Four incisors in upper jaw (two of them small and placed behind the others)	DUPLICIDENTATA.

Suborder *SIMPLICIDENTATA*.

Only two incisors in the upper jaw; enamel confined to the anterior surface. Anterior palatine foramina small or moderate, and distinct from each other. Bony palate well developed. The fibula does not articulate with the *os calcis*. Testes generally contained within the abdomen, and only descending in the rutting-season, when they form a great protuberance in the inguinal region.

To this suborder belong by far the greater number of rodents, divided into the following sixteen families, of which only five are represented in India.

A. Angular portion of mandible arising from lower edge of bony socket of incisor.	
a. Fibula distinct; zygomatic arch slender, chiefly formed by malar, which is not supported by a long maxillary process beneath it	**SCIUROMORPHA.**
Skull with distinct postorbital processes; pm. $\frac{2}{1}$.	1. **Sciuridæ.** **Anomaluridæ** (Africa). **Haplodontidæ** (N. America). **Castoridæ** (N. Europe, Asia, and America).
b. Fibula united to tibia; zygomatic arch slender; the malar rarely extending far forwards and usually supported by a long process from the maxillary; no postorbital processes	**MYIOMORPHA.**
a′. Form slender, hind limbs greatly elongate, metatarsals often united; infraorbital foramen very large, rounded; tail long, hairy.	2. **Dipodidæ.**
b′. Infraorbital foramen large, usually high, narrow below; lower root of zygomatic maxillary process flattened	3. **Muridæ.**

GSL

c′. Form heavy, cylindrical, mole-like; limbs short, tail short or rudimentary; infraorbital foramen small, lower maxillary zygoma-root not flattened ...... 4. **Spalacidæ.**

Myoxidæ (Palæarctic and Africa).

Lophiomyidæ (Africa).

Geomyidæ (America).

B. Angular portion of mandible arising from outer side of bony socket of incisor. Fibula distinct. Zygomatic arch stout .... **HYSTRICOMORPHA.**

Body more or less covered with spines. 5. **Hystricidæ.**

(South America.) **Octodontidæ.** **Chinchillidæ.** **Dasyproctidæ.** **Dinomyidæ.** **Caviidæ.**

Family SCIURIDÆ.

The squirrels, flying-squirrels and marmots, forming the present family, are distinguished by the following characters:—Tail hairy. Skull with distinct postorbital processes; infraorbital foramen small; palate broad; premolars $\frac{2-2}{1-1}$, the anterior upper premolar small, sometimes deciduous; molars rooted, tubercular in young animals, the crowns when worn exhibiting deep and often wavy folds of enamel.

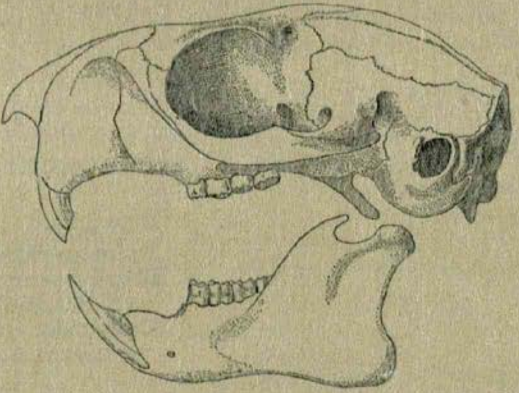

Fig. 119.—Skull of *Sciurus bicolor*, × ¾.

There are two subfamilies thus distinguished:—

A. Form slender, tail long, incisors compressed; chiefly arboreal .... *Sciurinæ.*

B. Form stout, tail generally short, incisors not compressed; terrestrial.................... *Arctomyinæ.*

Subfamily SCIURINÆ.

Of this subfamily, which inhabits all the great zoological regions except the Australian, the following four genera occur within Indian limits.

A. Limbs connected by a membrane or parachute.
  a. Hypsodont: inner borders of upper molars proximally subangulate, their upper surface flat .... EUPETAURUS.
  b. Brachydont: inner borders of upper molars rounded, their upper surface irregular.
    a′. An interfemoral membrane attached to the tail, which is bushy, not distichous .... PTEROMYS.
    b′. No interfemoral membrane; tail distichous .. SCIUROPTERUS.
B. Limbs free, not connected by membrane .... SCIURUS.

All the Indian forms of these genera (except *Eupetaurus*, which is a recent discovery) were described and a full synonymy given by Dr. Anderson in his 'Anatomical and Zoological Researches.'

Genus EUPETAURUS, O. Thomas (1888).

Hypsodont, the molars having high crowns, with the grinding-surface perfectly flat and not very complicated. Upper molars peculiarly shaped, the crowns almost semi-oval, with a subangular apex inside, placed at the proximal extremity of each tooth, so that the greatest breadth of the tooth is oblique. Interfemoral membrane rudimentary or wanting. Cartilage supporting the lateral membrane short. In other characters this genus resembles *Pteromys*.

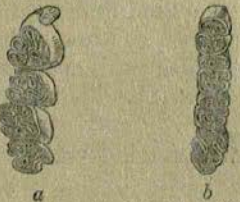

Fig. 120.—Crowns of right cheek-teeth of *E. cinereus*; *a*, upper; *b*, lower. × 1.

Only a single species is known.

226. **Eupetaurus cinereus.** *The woolly Flying-Squirrel.*

Eupetaurus cinereus, *Thomas, J. A. S. B.* lvii, pt. 2, p. 258, pls. xxii, xxiii (1888).

Claws blunt. Single metatarsal pad small, oval, isolated. Ears moderate, densely hairy outside, more thinly inside the conch. Fur very long, thick and soft, underfur dense and woolly. Tail cylindrical.

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Colour dull greyish brown to brownish grey above, paler, sometimes ashy brown, below. Feet darker, sometimes blackish brown. Basal half or more of dorsal fur leaden grey, terminal portion whity brown with a dusky ring near the end. Ventral fur ashy with whity-brown tips.

Dimensions not accurately known. Skins measure, head and body about 18 inches, tail with hair about 22; basal length of skull about 2·7, zygomatic breadth 1·8.

Distribution. Gilgit, about 6000 feet; probably also found at higher elevations. A skin was obtained by the late Mr. Mandelli, probably from some part of Tibet.

Habits unknown. The blunt claws probably show that the animal lives on rocks, perhaps amongst precipices, whilst the dense fur indicates a very cold climate.

Genus **PTEROMYS**, Cuv. (1800).

Limbs united by a membrane or parachute extending to the toes and supported by a bony cartilage attached to the ulnar (outer) side of the wrist, and usually long enough when laid back to extend to the elbow or beyond. There is an antebrachial membrane from the fore limb to the side of the neck, and an interfemoral membrane extending down the hind limb to the heel, and attached to the first two or three inches of the tail, which is bushy, cylindrical, and as long as the head and body or longer. Fur soft and rather long on the back.

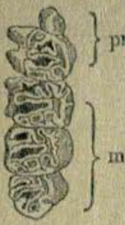

Fig. 121.—Right upper cheek-teeth of *P. magnificus*. × ⅔.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$, as in *Sciurus*; molars large, crowns much complicated. Vertebræ (in *P. magnificus*): C. 7, D. 12, L. 7, S. 3, C. 30. Three pairs of mammæ, pectoral and ventral, none inguinal.

The large flying-squirrels constituting this genus comprise several closely allied forms, some of which are probably not entitled to specific rank. The following occur within our area. All flying-squirrels are, so far as is known, nocturnal animals.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Lower surface white or grey, upper brown. . *P. oral*, p. 361.
B. Lower surface rufous; no white spots on back.
  a′. Head above coloured like the back.
    a″. A short clearly defined black tip to tail.
      a‴. Back paler in colour than parachute. *P. inornatus*, p. 363.
      b‴. Back deeper in colour than parachute . . . . *P. magnificus*, p. 364.

CSL

b″. Tail-tip not black, or long and ill-defined .... *P. yunnanensis*, p. 364.
b′. Head much greyer than back .... *P. caniceps*, p. 365.
C. Lower surface rufous; white spots on back.. *P. punctatus*, p. 365.

227. **Pteromys oral.** *The large brown Flying-Squirrel.*

Pteromys philippensis?, *Gray apud Elliot, Madras Jour. L. S.* x, p. 217 (1839).
Pteromys oral, *Tickell, Calc. Jour. N. H.* ii, p. 401, pl. xi (1842); *Kelaart, Prod.* p. 55; *Anderson, An. Zool. Res.* p. 279; *Sterndale, Jour. Bombay N. H. Soc.* i, p. 70.
Pteromys petaurista, *Pallas, Blyth, J. A. S. B.* xvi, p. 865, xxviii, pp. 276, 286; *id. Cat.* p. 94; *Jerdon, Mam.* p. 174; *nec* Sciurus petaurista, *Pallas.*
Pteromys petaurista, var. cineraceus, *Blyth, J. A. S. B.* xvi, p. 865.
Pteromys cineraceus, *Blyth, J. A. S. B.* xxviii, p. 276; *id. Cat* p. 94; *id. Mam. Birds Burma*, p. 35; *Anderson, An. Zool. Res.* p. 281; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 165.

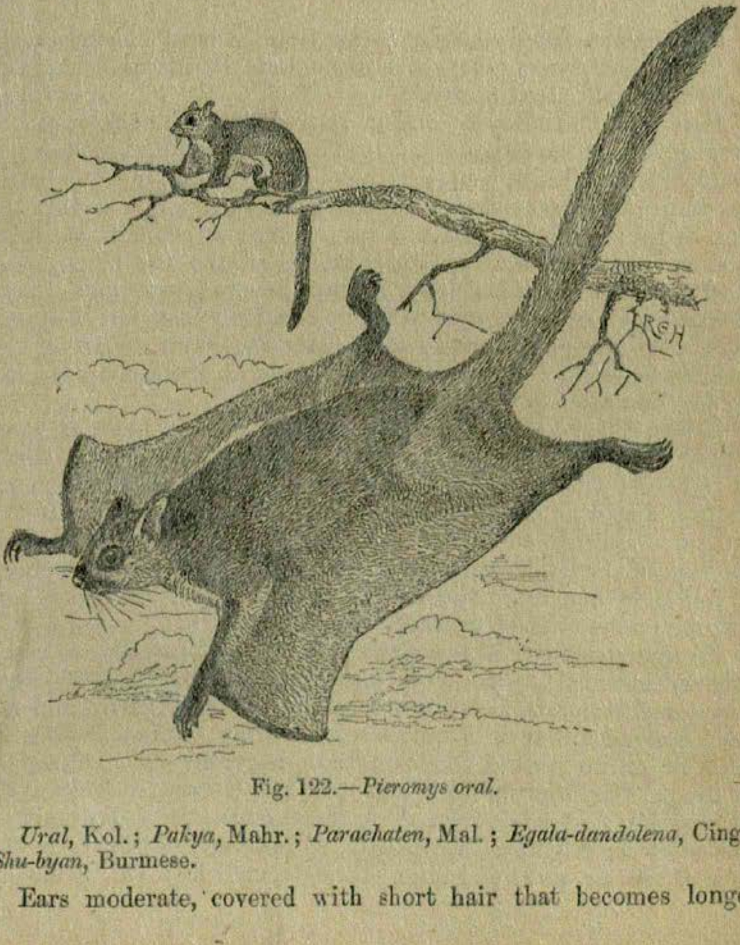

Fig. 122.—*Pteromys oral.*

Ural, Kol.; *Pakya*, Mahr.; *Parachaten*, Mal.; *Egala-dandolena*, Cing.; *Shu-byan*, Burmese.

Ears moderate, covered with short hair that becomes longer

GSL

towards the base outside; a large tuft of long hair behind each ear. On the fore foot are 3 toe- and 2 subequal metacarpal pads; on the hind foot 4 toe-pads, a large pyriform inner metatarsal pad, and a small supplementary pad behind the outer toe-pad.

Colour above grizzled brown, varying from deep chestnut to greyish brown in one direction and to sooty black in the other, the longer hairs partly white, producing a hoary appearance, especially on the head and body, less on the membrane and limbs; dorsal fur dark ashy blackish or brown towards the base, then brown or deep red or black, the longer hairs white for a distance near the end, extreme tips black. Feet dark, often black; tail sometimes black, brownish towards the base, in other skins light or dark grey with a black tip. Lower parts white, sometimes pure, more often greyish or brownish, especially on the membrane and around the vent.

Dimensions. Head and body 16 to 18 inches; tail without hair 22, with hair 24 to 25. Some published measurements are longer. Hind foot without claws 2·75 to 3; weight 5 lbs. A skull measures 2·5 in basal, 2·85 in extreme length, and 1·9 in zygomatic width.

Distribution. All the larger forests of the Indian Peninsula south of the Ganges, also Ceylon, and throughout Burma to Tenasserim and the Mergui Archipelago.

Varieties. The ordinary Indian form is dark brown, with the greater part of the tail black. *P. cineraceus*, the Burmese form, is much greyer, the upper parts ashy throughout, and the white speckling more conspicuous on the parachute than is usually the case in Indian skins. The tail too is grey or whitish, the hairs having long white terminations, the tip of the tail alone being black. Ceylonese skins from Kandy, however, are quite intermediate, and so is one sent to me by Mr. Daly from the Shevaroy hills. Travancore specimens often have the upper surface of the membrane bright chestnut. Bombay skins, on the other hand, are said by Sterndale to be grey.

Habits. The large Indian flying-squirrel lives in holes of trees during the day and comes out to feed, as a rule, quite in the dusk. It inhabits tree-forest, but in forest-tracts it may be found about villages, in mango-groves and similar places. It feeds like ordinary squirrels on fruits and nuts, also, according to Tickell, on the bark of certain trees, and on beetles and larvæ, but not on grain. It drinks by lapping. The voice is described by Tickell as a low soft monotone quickly repeated.

The flying-squirrel sleeps during the day, sitting, like so many arboreal mammals, with its back bent into a circle and its head thrust inside; or, in hot weather, lying on its back with the parachute extended. It is not so active as other squirrels, either on trees or on the ground, the parachute impeding its movements. When passing from one tree to another at a distance, it leaps, with its parachute extended, from the higher branches, and descends, at first more directly, then, apparently, by availing itself of the resistance of the air, more and more obliquely, until its flight, gradually

GSL

growing slower, becomes horizontal and finally terminates in an ascent to the trunk or branch of the tree to which its flight is directed. The movement of a flying-squirrel through the air must be similar to that of *Galeopithecus*, and in both cases the power of directing and, so to speak, steering its course must be possessed by the animal. Jerdon states that he has seen *P. oral* traverse a distance of sixty yards from tree to tree, and McMaster records a flight across the Prome road, near Rangoon, of nearly eighty yards.

Flying-squirrels are said to breed in holes of trees, but very little is known of the breeding-habits. These animals are easily tamed, but they are delicate, and but rarely live long in confinement. Most of the above details are from Tickell.

The name *philippensis* must have been given to the present species under the supposition that a Philippine flying-squirrel is identical. As this is not the case, the name is misleading and cannot be used.

228. **Pteromys inornatus.** *The large red Flying-Squirrel.*

Pteromys albiventer, *Gray, Charlesworth's Mag. N. H.* i, p. 584 (1837); *Blyth, J. A. S. B.* xvi, p. 865, xvii, p. 84; *Anderson, An. Zool. Res.* p. 286; nec *Gray and Hardwicke, Ill. Ind. Zool.*

Pteromys inornatus, *Geoffroy, Jacquemont, Voyage*, iv, *Mam.* p. 62, *Atlas*, ii, pl. iv (1844); *Blyth, J. A. S. B.* xxviii, p. 277; *id. Cat* p. 95; *Jerdon, Mam.* p. 176.

Pteromys magnificus, *Hodgson, apud Sclater, P. Z. S.* 1872, p. 635, pl. l, nec *Hodgson.*

Rusi gugar, Kashmiri.

Structure very similar to that of *P. oral* and skull of the same form. The large metatarsal pad joins the inner toe-pad on the hind foot. No supplementary pad.

Colour above chestnut, sometimes nearly uniform, sometimes the back and head much paler than the parachute, owing to the longer hairs being in part pale rufous or white. Dorsal fur at base dark ashy to blackish, then pale rufous passing into deep ferruginous, many of the longer hairs white or pale bright rufous for some distance near the end, and tipped black. Feet often black, also the orbits, whiskers, and a narrow band across the nose. Cheeks below the eyes grey or white. Tail rufous or brownish rufous, with a well-defined black tip, the hairs towards the base of the tail often with black terminations. Lower parts pale rufous.

Dimensions. Head and body 14 inches, tail 16, according to Jerdon. I believe, however, this squirrel grows nearly if not quite to the same size as *P. oral*. An adult skull is 2·85 inches long in extreme length and 1·85 broad across the zygomatic arches.

Distribution. The Western Himalayas, from 6000 to 10,000 ft., extending west to Murree, common in Kashmir and about Simla, found in Kumaon and in Nepal (Katmandu).

Habits. Precisely similar, so far as known, to those of *P. oral*. In Kashmir *P. inornatus* inhabits fir-trees and is said to hibernate.

229. **Pteromys magnificus.** *Hodgson's Flying-Squirrel.*

Sciuropterus magnificus, *Hodgson, J. A. S. B.* v, p. 231 (1836).
Pteromys magnificus, *Blyth, J. A. S. B.* xvi, p. 866, xxviii, p. 277; *id. Cat.* p. 95; *Jerdon, Mam.* p. 177; *Anderson, An. Zool. Res.* p. 285.
Sciuropterus nobilis, *Gray, A. M. N. H.* x, p. 263 (1842).
Sciuropterus chrysothrix, *Hodgson, J. A. S. B.* xiii, p. 67, pl. i, fig. 1 (1844).

Surâj-bhâgat, H.; *Biyom*, Lepcha.

Ears thinly clad, of moderate size. Skull shorter and broader than in *P. oral* and *P. inornatus*, and with the snout blunter. Hind foot as in *P. inornatus*.

Colour above varying, probably with the time of year. In *P. nobilis* or *chrysothrix*, which I suppose to be the summer garb, the body, neck, and head above are deep maroon, generally with a more or less well-marked yellow median line, commencing with a broad spot on the forehead. Sides of the neck and inner border of parachute, where it joins the body, yellowish buff, remainder of parachute rufous, often chestnut.

In the other phase, probably winter fur (*P. magnificus*), there is no median dorsal line, the body and head are chestnut above, more or less grizzled by some of the longer hairs being whitish near the tip, but the body above is always darker than the parachute. The dorsal hairs are dark ashy at the base. The feet are chestnut or black; the tail rufous with a well-defined black tip, the lower parts pale rufous.

Dimensions. Head and body 16 inches, tail 18 to 22, hind foot 3, ear 1½; weight 3¼ lbs. Basal length of a skull 2·5, extreme length 2·8, zygomatic breadth 1·95.

Distribution. The Himalayas from Nepal eastwards and the ranges south of the Assam valley, at elevations from 6000 to 9000 feet.

Habits. So far as known similar to those of *P. oral*. Hodgson's flying-squirrel is said by Jerdon to live on acorns, chestnuts, and other hard fruits, also on young leaves and shoots. Hodgson states that *P. magnificus* breeds in the rains in hollows of trees, and that it seems to produce but a single young one. The young are tolerably independent of the mother in September, but the parachute is much less developed than in adults.

230. **Pteromys yunnanensis.** *Anderson's Flying-Squirrel.*

Pteromys yunnanensis, *Anderson, A. M. N. H.* (4) xvi, p. 282 (1875); *id. An. Zool. Res.* p. 282, pl. xxii.

Similar in form to *P. magnificus* but apparently with larger feet.

Colour above bay, the fur of the head and body more or less thickly sprinkled over with white tips, giving a hoary appearance; the white tips are almost or quite wanting on the parachute, which is rather more rufous. Lower parts white, tinged with rufous near the parachute border and in the median line. Feet a little darker than body, not black. Tail rufous grey, becoming darker and blackish towards the end, but with no defined black tip.

Dimensions. Hind foot without claws 3·25 inches. In skins the head and body measure 18, tail 22.

Distribution. Hills south of Assam valley, extending eastward to Yunnan.

The specimen above described was from Cachar. The typical form from Yunnan has the tail black almost throughout. It is possible that this form passes into the Eastern Tibetan *P. alborufus*, to which Mr. W. L. Sclater informs me that he refers specimens from Assam and Burma.

231. **Pteromys caniceps.** *The grey-headed Flying-Squirrel.*

Sciuropterus caniceps, *Gray, A. M. N. H.* x, p. 262 (1842); *Blyth, J. A. S. B.* xvi, p. 866; *id. Cat.* p. 96; *Jerdon, Mam.* p. 178.
Sciuropterus senex, *Hodgson, J. A. S. B.* xiii, p. 68, pl. i, fig. 2 (1843).
Pteromys caniceps, *Gray, Cat. Mam. &c. Nepal & Thibet*, 1846, p. 21; *Anderson, An. Zool. Res.* p. 287.

Ears large, thin, almost naked. Skull smaller than in *P. oral* or *P. magnificus*. Metatarsal pad not in contact with toe-pad.

Colour above nearly uniform rufous-brown, the dorsal fur dark ashy at the base, then brown, pale rufous towards the end, and the tip black. Head throughout ashy grey or dull brown, finely speckled. Lower parts rufous, sometimes light chestnut, generally paler. Feet dull rusty red. Tail reddish brown like the back, the tip sometimes, not always, dusky or black.

Dimensions. Head and body 14 inches, tail without hair 16, with hair 18, ear 1¼, hind foot 2⅔; weight 2 lbs. Basal length of skull 2·2, extreme length 2·6, zygomatic breadth 1·6.

Distribution. Nepal and Sikhim, ranging west as far as Landour at a lower elevation than *P. magnificus*, about 4000 to 6000 feet.

The true *P. petaurista* of Pallas (*P. nitidus* of most authors), from the Malay peninsula and islands, may extend its range to Tenasserim. *P. melanopterus* and *P. alborufus* are found in Eastern Tibet and Southern China. All are closely allied to *P. magnificus*.

232. **Pteromys punctatus.** *The spotted Flying-Squirrel.*

Pteromys punctatus, *Gray, A. M. N. H.* xviii, p. 211 (1846); *Blyth, J. A. S. B.* xxviii, p. 277.

Ears almost naked except towards the base.

Colour. Upper parts rich yellowish brown, darker on the head, more rufous on the parachute and limbs; back and crown with small irregular white spots, composed of hairs that are white throughout, basal portion of all other hairs on upper parts dusky. Lower parts and sides of head pale rufous, deeper towards the edge of the parachute. Tail light rufous brown throughout.

Dimensions. A much smaller animal than *P. magnificus*, head and body (in a dried skin) about 14 or 15 inches. Basal length of skull about 2 inches, zygomatic breadth 1·7.

Distribution. A male specimen was obtained by L. Fea in Karennee, at about 4000 ft. The original type is more rufous, being bay above, and came from Malacca. I am indebted to Mr. Thomas for information about the discovery of this species in Burma.

Genus **SCIUROPTERUS**, F. Cuv. (1825).

Interfemoral membrane rudimentary, not including any portion of the tail. Lateral membrane less broad than in *Pteromys*, and the supporting cartilage shorter, not extending to the elbow.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$, as in *Sciurus* and *Pteromys*; the molars, however, are much less complicated than in *Pteromys*, and more like those of *Sciurus*; they wear, as a rule, into very strongly marked transverse ridges. The postorbital processes of the skull are directed somewhat backwards, as in *Sciurus*. Vertebræ: C. 7, D. 12, L. 7, S. 3, C. 27 (in *S. alboniger*).

In other respects the genus resembles *Pteromys*. In some species, as *S. alboniger* and *S. lepidus*, the mammæ are inguinal and ventral, in others pectoral and ventral, and always in three pairs.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. No pencils of long hair at base of ear-conch.
  a. Light brown above; head and body 10 inches. *S. fimbriatus*, p. 366.
  b. Hoary or blackish above; head and body 8·5. *S. alboniger*, p. 367.
  c. Yellowish brown above; head and body 6. . *S. sagitta*, p. 367.
  d. Chestnut above; head and body 5 inches . . *S. spadiceus*, p. 368.
B Pencils of hair, longer than ear, at base of conch.
  a. Head and body 10–12 inches; hind foot over 2. *S. fuscicapillus*, p. 368.
  b. Head and body 8 inches; hind foot 1·5 . . . . *S. pearsoni*, p. 369.

233. **Sciuropterus fimbriatus**. *The smaller Kashmir Flying-Squirrel.*

Sciuropterus fimbriatus, *Gray, Charlesworth's Mag. N. H.* i, p. 584 (1837); *id. P. Z. S.* 1837, p. 67; *Blyth, J. A. S. B.* xvi, p. 866; *id. Cat.* p. 96; *Jerdon, Mam.* p. 178; *Scully, P. Z. S.* 1881, p. 204.
Pteromys fimbriatus, *Anderson, An. Zool. Res.* p. 296; *Alston, P. Z. S.* 1879, p. 665.

Ears large, bluntly pointed, thinly clad, without any pencils of long hair at their base. The fringe of soft hair to the parachute and feet well developed. Tail slightly flattened. Skull elongate. A small supplementary pad on outer side of planta behind pad of 5th toe; metatarsal pad elongate, distant from toe-pads.

Colour above on the head, body, and membrane light brown, more or less mixed with black on the back. In rare cases the

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colour is rufous brown. Basal three fourths or more of the dorsal hair dark ashy, terminal portion light brown, extreme tip of longer hairs black. Lower parts white, sullied and brownish beneath the parachute. Tail brown, the hairs ashy at the extreme base, and with long black tips.

Dimensions. Head and body 10 inches long, tail without hair 10·5, with hair 12, ear outside 1·5, hind foot from heel 2·1; basal length of skull 2, extreme length 2·3, zygomatic breadth 1·4.

Distribution. Throughout the North-western Himalayas from Simla, and in all probability Kumaon to Kashmir, Gilgit, and Chitral, at considerable elevations, 6000 to 12,000 feet in Gilgit. Also found in Afghanistan, a specimen having been brought from Peiwar Kotal. This species is probably that named *S. baberi* by Blyth (J. A. S. B. xvi, p. 866) from Nijrow.

Habits. So far as is known, similar to those of *Pteromys*. Four young have been found in a female of this species.

234. **Sciuropterus alboniger.** *The particoloured Flying-Squirrel.*

Sciuropterus alboniger, *Hodgson, J. A. S. B.* v, p. 231 (1836); *Blyth, J. A. S. B.* xvi, p. 866; *id. Cat.* p. 97; *Jerdon, Mam.* p. 179; *Thomas, P. Z. S.* 1886, p. 59.
? Pteromys leachii, *Gray, Charlesworth's Mag. N. H.* i, p. 584 (1837).
Sciuroptera turnbulli, *Gray, P. Z. S.* 1837, p. 68; *Blyth, J. A. S. B.* xii, p. 928.
Pteromys alboniger, *Anderson, An. Zool. Res.* p. 298.

Ears large, thinly clad, without pencils at the base. Tail flat, distinctly distichous; hair on lower surface short. No supplementary pad on planta. Incisors pale yellow.

Colour above greyish brown, varying to rufous-brown, but hoary or much mixed with black from the dark underfur; the base of the hairs ashy passing gradually into black, only the ends light brown or grey, some of the longer hairs with black tips. Feet dark brown. Lower parts white; the fur dark grey at the base. Tail brown, the hairs frequently black-tipped. Young animals are black above, white below.

Dimensions. Head and body of a large specimen 11 inches long, tail without hair 8·25, with it 9; weight 9 oz.; others measure less. Extreme length of skull 1·9, zygomatic breadth 1·2.

Distribution. The Himalayas from Nepal eastward, at an elevation of 3000 to 5000 feet. Found also in the hills south of Assam, in Manipur, Yunnan, and Siam. Some skins in the British Museum from Borneo are also referred to this species.

235. **Sciuropterus sagitta.** *Horsfield's Flying-Squirrel.*

Sciurus sagitta, *L. Syst. Nat.* i, p. 88 (1766).
Pteromys horsfieldii, *Waterhouse, P. Z. S.* 1837, p. 87; *Anderson, An. Zool. Res.* p. 299.
Sciuropterus horsfieldii, *Cantor, J. A. S. B.* xv, p. 253.
Sciuropterus sagitta, *Blyth, J. A. S. B.* xxiii, p. 731, xxiv, p. 187, xxvii, p. 281; *Thomas, P. Z. S.* 1886, p. 75.

Sciuropterus phayrei, *Blyth, J. A. S. B.* xxviii, p. 278 (1859); *id. Cat.* p. 97; *id. Mam. Birds Burma*, p. 35.

Ears large, without pencils of hair at the base. Tail flat and distichous. Fur short and dense.

Upper parts throughout brown with a yellow tinge, the head coloured precisely like the back, and the tail scarcely differing. Fur ashy at the base, still darker on the parachute. Lower parts white or yellowish white. Tail brown above, redder beneath.

Dimensions of an adult male in spirit: head and body 6·25 inches, tail without hair 5, hind foot 1·25.

Distribution. Southern Pegu, Tenasserim, Cambodia, the Malay Peninsula, Java, and some of the other Malay islands. The most northern locality recorded is Shwe Gyeng, on the Sittoung River.

236. **Sciuropterus spadiceus.** *The pigmy Flying-Squirrel.*

Sciuropterus spadiceus, *Blyth, J. A. S. B.* xvi, p. 867, pl. xxxvi, fig. 1 (1847); *id. Cat.* p. 97; *id. Mam. Birds Burma*, p. 35.
Pteromys spadiceus, *Anderson, An. Zool. Res.* p. 300.

Kywek-shu-pyan, Arrakan.

Size very small. No pencils of hair at the base of the ears; tail distichous, flat, acuminate. Metatarsal pad oval.

Colour above chestnut, basal three fourths of dorsal fur sooty black, tips red. Membranes and limbs darker, tail dark brown, rufous below near the base. Lower parts white.

Dimensions. Head and body about 5 inches, tail 4½, tarsus 1¼. Skull 1·25 inches long (extreme length), zygomatic breadth 0·8.

Distribution. Arrakan, Moulmein, and Cochin China.

Thomas, P. Z. S. 1886, p. 75, advocates the amalgamation of *S. spadiceus* with *S. lepidus*, a very small Javan form. There appears to me, however, too much difference in colour and in the form of the tail, which in *S. lepidus* is webbed like a feather.

237. **Sciuropterus fuscicapillus.** *The small Travancore Flying-Squirrel.*

Sciuropterus fuscocapillus, *Jerdon, Blyth, J. A. S. B.* xvi, p. 867 (1847), xxviii, p. 286; *id. Cat.* p. 97; *Jerdon, Mam.* p. 180.
Sciuropterus layardi, *Kelaart, Blyth, J. A. S. B.* xx, p. 165 (1851); *Kelaart, Prod.* p. 56.
Pteromys fuscocapillus, *Anderson, An. Zool. Res.* p. 294.

A pencil of soft hairs, greatly exceeding the ear in length, at each base of the ear-conch, which is short and almost naked. Tail flat, bushy. Metatarsal pad very elongate, no supplementary outer pad. Fur long, soft. Skull broader than that of *S. fimbriatus*.

Colour above reddish brown, the dark underfur showing, especially on the parachute. Dorsal hair dark ashy at the base and for the greater part of its length, becoming blackish towards the end; terminal portion rufous brown, extreme tips of longer hairs black. On the parachute the hairs, except the brown tips, are black throughout. Sides of face whitish. Feet pale rufous-brown.

GSL

Lower parts rufescent white, the hairs dark grey near the skin. Tail rufous-brown, the hairs sometimes with black terminations. The extreme tip of the tail is sometimes white.

Dimensions. Head and body of an adult male in spirits 12 inches, tail without hair 9, with hair 10·5, hind foot 2·1, ear from crown 0·8, extreme length of skull 2·25, zygomatic breadth 1·45. Some individuals are possibly larger.

Distribution. Hills of Travancore and Ceylon, at moderate elevations. Anderson also gives the Nilgiris as a locality.

238. **Sciuropterus pearsoni.** *The hairy-footed Flying-Squirrel.*

Sciuropterus pearsonii, *Gray, A. M. N. H.* x, p. 263 (1842); *Thomas, P. Z. S.* 1886, p. 60.
Sciuropterus villosus, *Blyth, J. A. S. B.* xvi, p. 866 (1847); *id. Cat.* p. 96; *Jerdon, Mam.* p. 179.
Pteromys pearsonii, *Anderson, An. Zool. Res.* p. 293.

A pencil of soft hairs, greatly exceeding the ear in length, at each base of the ear-conch, which is small and fairly well clad. Tail flat, bushy. Toes with long hair, partly concealing the claws. No supplementary pad on planta; metatarsal pad oval. Fur long.

Colour above brown, frequently rufous-brown, grizzled by pale tips; dorsal hair sooty black for the greater part of its length, becoming ashy at the base, and tipped with ferruginous red, pale rufous, or light brown; extreme tip of some of the longest hairs black. Fur on upper surface of parachute black, with but few pale tips. Feet paler. Lower parts fulvescent white; more rufous, and sometimes brown or ferruginous beneath the parachute. Tail rufous-brown, paler below, sometimes tipped blackish.

Dimensions. Head and body 8 inches, tail 8, ear 0·6, hind foot and claws 1·5; zygomatic breadth of skull 0·9.

Distribution. Sikhim, Bhutan and the Eastern Himalayas, Assam, hills south of Assam, Cachar, Manipur, and Yunnan; also, according to Anderson, Formosa. In Sikhim this species inhabits a zone from 3000 to about 6000 feet.

Genus **SCIURUS**, L. (1766).

Limbs free, not connected by membrane; tail long, bushy. Hind feet with five toes, fore feet with four toes and a rudimentary thumb. No cheek-pouches.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3\ 3}$. Anterior upper premolar soon lost in some species, but not in others. Postorbital processes moderate, and generally directed backwards. The small infraorbital foramen is in front of the zygoma-root, and close to the anterior premolar. Palate broad and flat. Vertebræ: C. 7, D. 12–13, L. 6–7, S. 3, C. 21–32.

Squirrels are mainly arboreal and diurnal, they feed on fruit, seeds, nuts, leaf-buds, and sometimes it is said on insects and birds' eggs. They hold their

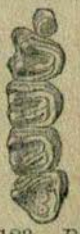

Fig. 123.—Right upper cheek-teeth of *S. erythræus*, ×2.

food between their fore feet when eating. They build large nests of leaves, grass, &c. in trees, and usually produce three or four young. The Indian and Burmese species are numerous, but fall into three groups, easily recognized by size and other characters.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Large squirrels; nose to vent not less than 12 inches; lower surface of tail with short hair; usually 4 teeth in upper molar series on each side.
  - *a.* Outside of all limbs coloured like upper parts, which are generally blackish........................ *S. bicolor*, p. 373.
  - *b.* Outside of hind limbs like back, wholly or partly maroon, of fore limbs buff like abdomen .... *S. indicus*, p. 371.
  - *c.* Outside of all limbs pale like abdomen. *S. macrurus*, p. 374.
- B. Medium-sized squirrels; nose to vent 7 to 10 inches; lower surface of tail with long hair; no pale longitudinal bands on back or sides; usually 5 teeth in upper molar series.
  - *a.* Colour throughout body above and below red or reddish brown ...... *S. ferrugineus*, p. 375.
  - *b.* Colour not uniform, back finely speckled.
    - *a′.* Longer dorsal hairs with but one pale ring; a small white or whitish spot behind each ear.
      - *a″.* Abdomen rufous .... *S. locria*, p. 376.
      - *b″.* Abdomen white .... *S. rufigenis*, p. 376.
    - *b′.* Longer dorsal hairs with two pale rings; no white spots behind ear.
      - *a″.* Neither a black dorsal patch nor white whiskers.
        - a^3. Abdomen chestnut or bay .. *S. erythræus*, p. 377.
        - b^3. Abdomen longitudinally banded white and black ...... *S. quinquestriatus*, p. 378.
        - c^3. Abdomen pale rufous or isabelline or grey.
          - a^4. A distinct black tail-tip.
            - α. A black or blackish band on each side of abdomen *S. phayrei*, p. 379.
            - β. No black lateral bands.
              - α′. Abdomen pale rufous. *S. pygerythrus*, p. 379.
              - β′. Abdomen pale grey .. *S. caniceps*, p. 380.
          - b^4. Either no black tail-tip or a very ill-defined one.
            - α. Feet whitish............ *S. griseimanus*, p. 381.
            - β. Feet the same colour as the sides .... *S. locroides*, p. 381.
      - *b″.* Either a black dorsal patch or white whiskers, or both * .... *S. atridorsalis*, p. 382.

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* A rufous variety of this occurs with black whiskers, and no black on the back. This is scarcely distinguishable from some forms of *S. erythræus*.

CSL

- C. Small striped squirrels; nose to vent 5 to 7 inches; back with pale longitudinal bands; upper cheek-teeth generally 5.
  - *a.* A pale line in middle of back; ears not pencilled.
    - *a′.* Pale dorsal stripes distinct, extending throughout the back.
      - *a″.* Pale stripes subequal, each more than $\frac{1}{10}$ inch broad; skull 1·8 inch long .... *S. palmarum*, p. 383.
      - *b″.* Pale stripes subequal, each less than $\frac{1}{10}$ inch broad; skull 1·55 long...................... *S. tristriatus*, p. 384.
      - *c″.* Middle pale stripe broader and much more distinct than lateral *S. layardi*, p. 385.
    - *b′.* Pale dorsal stripes narrow, indistinct, confined to the middle of back .... *S. sublineatus*, p. 385
  - *b.* A black line in middle of back; head and body 5 inches; ears pencilled. . *S. macclellandi*, p. 386.
  - *c.* No pale line in middle of back; head and body 7 inches; ears not pencilled .... *S. berdmorei*, p. 387.

The group of medium-sized squirrels contains so many variable races, and intermediate forms between some of them are so frequently met with, that the key here given may not always suffice to distinguish individual specimens. It is doubtful whether some of the small striped squirrels have any genetic connexion with the others similarly marked.

239. **Sciurus indicus.** *The large Indian Squirrel.*

Sciurus indicus, *Erxleben, Syst. Regn. An.* p. 420 (1777); *Anderson, An. Zool. Res.* p. 222; *Thomas, P. Z. S.* 1886, p. 60.
Sciurus purpureus, *Zimmermann, Spec. Zool. Geog. Quad.* p. 518 (1777); *Blyth, J. A. S. B.* xvi, p. 868.
Sciurus malabaricus, *Scopoli, Del. Faun. Flor. Ins.* ii, p. 85 (1786); *Schinz, Syn. Mam.* ii, p. 32; *Jerdon, Mam.* p. 166.
Sciurus maximus, *Schreber, Säugth.* iv, p. 784, pl. ccxvii B (1784); *Elliot, Mad. Jour. L. S.* x, p. 217; *Blyth, J. A. S. B.* xxviii, p. 287; *id. Cat.* p. 98; *Jerdon, Mam.* p. 166; *Ball, P. A. S. B.* 1877, p. 170; *Anderson, An. Zool. Res.* p. 223.
Sciurus elphinstonii, *Sykes, P. Z. S.* 1831, p. 103; *Jerdon, Mam.* p. 167.

Karrát, Rasu, Ratuphar, Jangli gilheri, H.; *Kát berral*, Beng.; *Hondeng*, Kol.; *Shekra*, Mahr.; *Kes annalu*, Can.; *Bet udata*, Tam.

Ears with long dense tufts. Skull with the muzzle broader and teeth larger than in *S. bicolor*.

Colour. The upper parts, including the ears and nape, are either wholly ferruginous red (rich chestnut or maroon), or the red is more or less replaced by black on the shoulders, middle of the back, rump, thighs, and tail. There is always a pale band across the vertex just in front of the ears; the forehead is chestnut or rufous-brown, or pale brown, frequently more or less grizzled with white. Sides of the head and muzzle yellowish brown or buff, sometimes with a rufous tinge. A chestnut stripe down the side of the neck from in front of the ear. Lower parts buff or yellowish brown. Dorsal fur blackish or dark brown near the skin, ventral dusky. In specimens wholly or chiefly red above, the terminal portion of the tail, from a quarter to more than half, is sullied white or buff, and the lower surface of the tail is pale throughout; in darker skins the lower surface of the tail is dull red or brown.

Dimensions. Head and body 16 to 18 inches; tail rather less, or, with hair, one or two inches more. In a Malabar specimen, head and body 17 inches, tail 14·5; weight 4½ lbs. Basal length of a skull 2·6 inches, zygomatic breadth 1·8 The Bombay variety, with back and tail entirely red, appears rather smaller than the Malabar and Bengal forms.

Distribution. Throughout the Peninsula of India, south of the Ganges, Soane, and Nerbudda, in all extensive forests, and also to the eastward in Manipur, so this squirrel should be looked for in Cachar, Chittagong, Tipperah, &c. Hodgson once (P. Z. S. 1855, p. 126) incidentally mentioned *S. purpureus* amongst the mammals of the Nepal Terai; but as no such animal is comprised in his lists of Nepal mammals, and no specimen exists in his collections, the name was doubtless inserted in error. *S. indicus* is common in Orissa, Bastar, and parts of Chutia Nagpur, also in the Western Gháts.

Varieties. This species was divided into three by Jerdon, and into two by Anderson. I think all the three forms distinguished by the first-named well marked races. They are:—

1. The Bombay Squirrel of Pennant, from which *S. indicus* and *S. purpureus* were named, and which was subsequently called *S. elphinstonii.* All the upper parts are red, no black occurring; tail-tip whitish. This appears rather smaller than other varieties, and inhabits the northern part of the Western Gháts, but has been obtained by Sir O. B. St. John as far south as Mysore.
2. *S. maximus* of Jerdon, not of Schreber. This is chiefly red above, but there is some black on the shoulders and upper part of the tail, the tip of which is usually yellowish. This race, which has no special name, is found in Orissa, Bastar, Chutia Nagpur, South-western Bengal, and Manipur.
3. *S. malabaricus* or *S. maximus* (both founded on Sonnerat's Great Malabar Squirrel). Shoulders, rump, and tail, with more or less of the back, black. This is found in Southern Malabar and parts of Central India. There is a specimen in the British Museum from the source of the Nerbudda.

Habits. The large red squirrel inhabits high trees in forests, living amongst the branches and rarely coming to the ground. It makes a large nest of twigs and leaves near the top of a lofty tree. A tame animal kept by Mr. Sterndale made nests in several trees, and the same animal was observed to jump 20 feet from one tree to another. This squirrel moves about and feeds at all hours of daylight, except perhaps the middle of the day. The voice is a loud quickly repeated cry. Young animals are easily tamed, but are not very docile or intelligent.

240. **Sciurus bicolor.** *The large Malay Squirrel.*

Sciurus bicolor, *Sparrman, Gotheb. Vet. Svensk. Handl.* i. p. 70 (1778); *Blyth, J. A. S. B.* x, p. 919, xvi, p. 870; *id. Cat.* p. 99; *Cantor, J. A. S. B.* xv, p. 246; *Anderson, An. Zool. Res.* p. 215.
Sciurus giganteus, *McClelland, P. Z. S.* 1839, p. 150; *Anderson, An. Zool. Res.* p. 220.
Sciurus macruroides, *Hodgson, J. A. S. B.* x, p. 915 (no description); *Jerdon, Mam.* p. 168; *Blyth, Mam. Birds Burma,* p. 35.

Shingsham, Bhot.; *Satheu,* Lepcha; *Leng-thek,* Arrakan; *Sheng, Sheng apan,* Burmese; *Chingkrâwah,* Malay; *Meng-khan,* Talain; *Khabong,* Karen.

Mammæ 6, all inguinal.

Colour. All the upper parts, the outside of all limbs, and tail black or brownish black or brown, lower parts to the vent buff. The dark colour of the face extends around the eyes and ears; a stripe extends backward and downward from the nose behind the gape and below the eye, and there is a dark spot on the chin. Fur of the same colour throughout above; the basal portion of the hairs is dusky below, and becomes conspicuous when the fur is worn.

Dimensions. In the Himalayan form the head and body measure about 16 inches, tail without hair 17 to 22, hair at the end 3 to 4 inches more, hind foot 3·5; basal length of skull 2·75, zygomatic breadth 1·9; weight 4½ lbs. In a very large individual, according to Cantor, the head and body measured 18 inches, tail 21·5.

Distribution. The Eastern Himalayas of Nipal, Sikhim, and Bhutan, also all the hill-regions and large tree-forests of Assam, Manipur, Burma, Siam, the Malay Peninsula, Sumatra, Java, Borneo, and even, it is said, Celebes.

Varieties. In the Malay Peninsula and Islands there are several races of this squirrel, to many of which names have been given, and the coloration of which varies greatly, one Malaccan variety having a whity-brown (*café au lait*) colour above throughout, whilst others are varied in tint, and some grizzled. The hairs of the tail are often white at the base or at the tips. In the Irrawaddy delta, and perhaps in Martaban and Tenasserim, a variety is common with a broad pale band or patch across the back. The worn summer fur is often paler brown, wholly or in patches, the fresh winter coat nearly black. There is, moreover, much variation in size, Himalayan squirrels being largest, whilst many of the Malay forms are considerably smaller. The distinction, however, upon which most stress has been laid is the presence or absence of ear-tufts. All Himalayan and Arrakan specimens have, on the outside of the ear-conch, a tuft of long hairs, which is wanting in other Burmese skins, especially those from Tenasserim, and in Malaccan specimens. But there are gradations; and squirrels of this species with tufted ears are recorded even from Borneo. It should be remembered that the common European squirrel has tufted ears in winter, but not in summer. The difference in the two races of *S. bicolor* is, probably, due to habitat, the form inhabiting colder countries, such as the Himalayas, having tufted ears. Anderson, Jentink, and others distinguish the larger form with tufted ears as *S. giganteus* (*S. macruroides* of other writers).

Habits. Very similar to those of *S. indicus*. This species inhabits high trees, generally in pairs. It feeds on fruits and nuts of various kinds, and is said by Tickell to eat birds' eggs and insects. The voice, according to the same observer, is a loud harsh cackle.

241. **Sciurus macrurus.** *The grizzled Indian Squirrel.*

Sciurus macrourus[*], *Pennant, Indian Zoology*, pt. 1, pl. i (1769), *teste Erxleben, Syst. Regn. An.* p. 420; *Blyth, J. A. S. B.* xvi, p. 869, pl. xxxvi, fig. 2, xviii, p. 601, xx, p. 165; *id. Cat.* p. 100; *Kelaart, Prod.* p. 49; *Jerdon, Mam.* p. 168; *Anderson, An. Zool. Res.* p. 224.
Sciurus ceylonicus, *Erxleben, Syst. Reg. An.* p. 416 (1777).
Sciurus tennantii, *Layard, Blyth, J. A. S. B.* xviii, p. 600 (1849), xx, p. 165; *id. Cat.* p. 100; *Kelaart, Prod.* p. 50.

Rukiya, Dandolena, Cingalese; *Peria-anathan*, Tamul.

Ear sometimes very slightly tufted, sometimes not.

Colour. Upper surface and tail grey or brownish grey, more or less grizzled with white, especially on the sides and tail, except in the variety *S. tennanti*, in which the upper parts and tail are quite black. A pale band across the crown of the head between the ears. Lower parts with the whole forearm and lower parts of tibia all round buff or whitish. Forehead dark, generally black or blackish; sides of head and end of muzzle pale; ears usually dark, but not always. A black streak behind the eye down the side of the neck, often indistinct, but sometimes double. Toes and sometimes the whole feet black. Terminal portion of tail occasionally with long white tips to the hairs. Basal half of dorsal fur dark brown, of ventral dusky.

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[*] *S. macrurus*, Gray and Hardwicke, Ill. Ind. Zool. ii, pl. xix, is not this species, but, I think, a variety of *S. bicolor*. *S. albipes*, Blyth, J. A. S. B. xxviii, p. 287, though referred to *S. macrurus* by Anderson, is also, I think, *S. bicolor*.

Dimensions. Head and body 13 to 15½ inches, tail rather less, or with the hair rather more. Basal length of skull 2·15, width across zygomatic arches 1·6.

Distribution. Ceylon and the Southern part of the Indian Peninsula, in forests, especially hill-forest. The most northerly localities known are the Shevaroy Hills (whence skins have been sent to me by Mr. Daly), Mysore, and the Nilgiris.

Varieties. The colour varies considerably, and according to Kelaart changes from dark brown to grizzled grey with the seasons, but the only race deserving of notice is that called *S. tennantii* by Layard. This is peculiar to the higher ranges in Ceylon, is decidedly larger in size than typical *S. macrurus*, and has the upper parts, tail, and toes perfectly black, some white tips being occasionally, not always, found on the hair of the tail. Forearm and tibia outside and inside coloured like the abdomen as usual.

I can find nothing especial recorded of the habits.

242. **Sciurus ferrugineus.** *The bay Squirrel.*

Sciurus ferrugineus, *F. Cuv. Hist. Nat. Mam.* pl. 238 (1829); *Blyth, J. A. S. B.* xxxi, p. 332; *id. Cat.* p. 101; *id. Mam. Birds Burma*, p. 36; *Anderson, An. Zool. Res.* p. 243; *M.-Edwards, Bull. Soc. Philom.* sér. 7, i, p. 16.

Sciurus keraudrenii, *Reynaud, Lesson, Cent. Zool.* p. 11, pl. i (1830); *Blyth, J. A. S. B.* xvi, p. 872, xxiv, p. 474; *Blanford, J. A. S. B* xxxi, p. 194.

Colour rich ferruginous red almost throughout, varying from bright to deep chestnut and to brownish red, the middle of the back sometimes darker, the paws occasionally blackish, and the end of the tail in one variety white.

Dimensions. Head and body 8 to 10 inches, tail without hair 9 to 12, with hair 11 to 15, hind foot 1·85 to 2·1. The large dimensions are from a Bhámo specimen; the smaller from a Rangoon one preserved in spirit.

Distribution. Throughout Upper Burma, Arrakan, Pegu, and Siam, but not recorded from Martaban or Tenasserim. Common near Rangoon. I have a skin of a rusty-red squirrel from Sikhim which may belong to the present species.

Varieties. In Burma the variation in this squirrel is only from bright chestnut to brownish red, but Anderson and others unite with this form the white *S. finlaysoni* from Siam, the jet-black *S. germani* from the island of Sichang, and other forms, some of them grizzled brown. If *S. finlaysoni* be really identical, the name which was given by Horsfield, in his 'Zoological Researches in Java,' published in 1824, has priority over *S. ferrugineus.* See Anderson, l. c.

243. Sciurus locria. *The orange-bellied Himalayan Squirrel.*

Sciurus lokriah, *Hodgson, J. A. S. B.* v, p. 232 (1836); *Blyth, J. A. S. B.* xvi, p. 873, xxiv, p. 475; *id. Cat.* p. 104; *id. Mam. Birds Burma*, p. 37; *Jerdon, Mam.* p. 169; *Anderson, An. Zool. Res.* p. 250

Sciurus locria, *Hodgson, J. A. S. B.* x, p. 915.

Sciurus subflaviventris, *MacClelland, Gray, List Mam. B. M.* p. 144 (1843), no description; *Horsfield, Cat.* p. 152.

Lokria, Nepal; *Zhamo*, Bhot.; *Kalli* or *Kalli ting-dong*, Lepcha.

Tail shorter than the head and body. Snout elongate, narrow. Teeth small. Length of the five upper molars together about half that of the nasals. Three pairs of mammæ, 1 pectoral, 2 inguinal.

Colour above usually dark rufous-brown, slightly speckled, sometimes speckled dark yellowish brown, sides a little paler. Dorsal fur leaden black at the base, the longer hairs having a single yellow ring and a long black tip. A white or whitish patch behind each ear, often concealed by the conch. Lower parts from chin to vent more or less orange, varying from pale to bright rusty red; the rufous colour is often confined to the middle of the abdomen, and passes gradually into the brown of the sides. Tail not distinctly annulated, blackish or dark brown throughout, sometimes hoary, the hair whitish or pale rufous at the base, then deeper rufous, a dusky ring intervening sometimes, the terminal portion black, sometimes with the extreme tip white.

Dimensions. Head and body 8 inches, tail without hair 5·75, with hair 8·25; basal length of skull 1·2, extreme length 2, zygomatic breadth 1·1. Weight 7 ounces.

Distribution. Nepal, Sikhim, and hills north and south of Assam, Manipur, and Arrakan. This species occurs chiefly, perhaps exclusively, at some elevation above the sea, in Sikhim up to 7000 or 8000 feet.

This squirrel may be distinguished from *S. locroides* by its longer and more pointed nose and smaller molars, by having one yellow ring instead of two on the longer dorsal hairs, by the whitish patch behind the ear, and by the want of distinct annulation in the tail-hairs, also generally by being more rufous above and below. To the same peculiar group as *S. locria* belong *S. pernyi* and *S. rufigenis*, the three being in fact little more than local races of the same species.

244. Sciurus rufigenis. *The red-cheeked Squirrel.*

Sciurus rufigenis, *Blanford, J. A. S. B.* xlvii, pt. 2, p. 156, pls. vii, viii (1878); *Thomas, P. Z. S.* 1886, p. 71.

Tail without hair considerably shorter than the head and body. Snout elongate, pointed. Much woolly underfur mixed with the hair on the back.

Colour above and on sides of body a fine mixture of yellow and black, the general tint speckled yellowish brown, darker in the middle of the back. Dorsal hairs dark slaty at the base, then black with one pale yellow ring near the end. A distinct whitish spot behind each ear, often concealed by the conch. Muzzle rufous; cheeks bright ferruginous red, vibrissæ black; chin and fore neck white, sometimes more or less tinged with rufescent; breast and abdomen purer white, the hairs dusky at the base. Tail nearly black above, rich ferruginous below, the hairs on the upper surface black with one white ring near the base and white tips; on the lower surface, chestnut with long black white-tipped terminations. The red beneath the tail extends around the vent and to the back of the thighs.

Dimensions. Head and body 8 inches, tail without hair 6·5, with hair 7·8, hind foot 1·8; extreme length of skull from occiput to end of nasals 2·1, basal length about 1·75, zygomatic breadth 1·2.

Distribution. The sides of Muleyit mountain about 70 miles east of Moulmein, in dense forest at an elevation of 4000 to 6000 feet. Also found in Karennee by Mr. L. Fea. An allied species, *S. pernyi*, occurs in Se-chuen, China.

245. **Sciurus erythræus.** *Pallas's Squirrel.*

Sciurus erythræus, *Pallas, Glires*, p. 377 (1778); *Blyth, J. A. S. B.* xi, p. 970, xvi, p. 872, xxiv, p. 473; *id. Cat.* p. 102; *Anderson, An. Zool. Res.* p. 236; *Thomas, P. Z. S.* 1886, p. 61.
Sciurus hippurus, *McClelland, P. Z. S.* 1839, p. 151; *Horsfield, Cat.* p. 154, partim, *nec Geoffroy*.
Sciurus erythrogaster, *Blyth, J. A. S. B.* xi, p. 970 (1842), xvi, p. 871, xxiv, p. 473; *id. Cat.* p. 102.
? Sciurus piceus, *Peters, P. Z. S.* 1866, p. 429.
Macroxus punctatissimus, *Gray, A. M. N. H.* (3), xx, p. 283 (1867).
Sciurus sladeni *and* S. gordoni, *Anderson, P. Z. S.* 1871, pp. 139, 140; *id. An. Zool. Res.* pp. 240, 242, pls. xix, xx.

Kherwa, Manipuri.

Tail bushy, longer than head and body. Two pairs of mammæ, ventral and inguinal. Soles of feet smooth, not tubercular, between the pads.

Colour above varying from almost black through speckled blackish olive to pale olive and to rufous or yellowish brown, or occasionally speckled grey. Hairs leaden black at the base, then yellow (whitish or orange) and black alternately, usually two rings of each, the tip black. Lower parts varying from rusty red to deep bay, usually rich chestnut; in some varieties the chin, fore neck, and a stripe down the middle of the abdomen are of the same speckled olive or brown colour as the sides. In some forms too the ears and muzzle, and in one race (*S. sladeni*) the head and feet, are bright ferruginous like the lower parts. The tail is either rufous throughout or annulated by each hair having six or eight alternating rings of black and grey, and the terminal portion, varying from the tip to the greater part of the tail, is either black or ferruginous red.

Dimensions. A Manipur male measured, head and body 7·5 inches, tail without hair 9·5, with hair 12. Judging from other skins, the tail may in this case have been proportionally longer than

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usual. Extreme length of skull from occiput to end of nasals 2, basal length 1·75, zygomatic breadth 1·15.

Distribution. Assam, the hills to the south (Khási, Gáro, &c.), Cachar, Chittagong, Manipur, and Upper Burma; also (if, as I believe, *S. castaneoventris* is not distinguishable) China. *S. piceus* is said to be from Tenasserim.

Varieties. The following are the principal races that I include under *S. erythræus*:—

1. Typical *S. erythræus* from the Khási hills and neighbourhood. This has the upper surface light olive, lower parts chestnut, and the terminal portion of the tail, two thirds or more, coloured like the belly, the extreme tip sometimes whitish; the ears are rufous.
2. *S. erythrogaster* from Manipur. Upper surface dark olive, lower parts chestnut to bay, feet and terminal half or more of the tail black.
3. *S. punctatissimus* (and, as I believe, *S. piceus* of Peters) from Cachar. Upper parts very dark almost black, tail and feet black, lower parts dark bay.
4. *S. gordoni* from Upper Burma, north of Ava. The upper parts brown or olive, more or less rufescent; lower parts pale to deep ferruginous, with a distinct median band along the breast and abdomen coloured and speckled like the sides, the throat and fore neck sometimes speckled olive, sometimes ferruginous. Tail annulated, tip rufous or white, sometimes a black bar between the annulated part and the rufous or white tip. A very similar variety is found in Upper Assam.
5. *S. sladeni* from Thigyain, Upper Burma. Upper parts speckled rufous-olive. Head, feet, termination of the tail, and all the lower parts ferruginous red.

246. **Sciurus quinquestriatus.** *Anderson's Squirrel.*

Sciurus quinquestriatus, *Anderson, P. Z. S.* 1871, p. 142, pl. x; *id. An. Zool. Res.* p. 266; *Blyth, Mam. Birds Burma*, p. 37.

Posterior foot-pads on hind feet linear, soles between pads smooth.

Colour above and on the sides black and yellow or orange mixed to form a speckled brown or olive; dorsal fur leaden black at the base, then annulated with alternate rings of yellow and black, the tip black; the middle of the back often more rufous. Breast and belly white, with three longitudinal dark brown or black stripes, sometimes punctulated, one stripe median, the other two lateral between the white and the olive of the side; the white is sometimes reduced to two narrow stripes. Tail the same colour as the back except at the tip; tail-hairs annulated with yellow or whitish and black, four or five rings of each colour, terminal hairs black with white tips.

Dimensions. Head and body 9½ inches, tail without hair 9, hind foot 1·9; basal length of skull 1·8, zygomatic breadth 1·2.

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Distribution. Only obtained as yet on the Kakhyen hills near Bhámo, Upper Burma.

247. **Sciurus phayrei.** *Phayre's Squirrel.*

Sciurus phayrei, *Blyth, J. A. S. B.* xxiv, pp. 472, 476 (1855), xxxi, p. 332; *id. Cat.* p. 104; *id. Mam. Birds Burma*, p. 36; *Peters, P. Z. S.* 1866, p. 429; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 160; *Anderson, An. Zool. Res.* p. 230.
Sciurus caniceps phayrei, *Thomas, P. Z. S.* 1886, p. 69.

Colour. Upper parts speckled greyish brown, the back sometimes with a rufous tinge; dorsal hairs leaden black at the base, then isabelline and black alternately, two rings of each, the tip black. Feet and lower parts light rufous, a black or blackish band on each side of the rufous abdomen from axil to groin. Tail concolorous with the back above and at the sides; below, in the middle, at all events towards the base, pale rufous like the abdomen; tip of the tail black for one or two inches; tail-hairs generally with 4 or 5 rings of each colour, isabelline and black.

Dimensions. Head and body of a female 9·6 inches, tail, without hair 8·8, with hair 11, hind foot from heel 1·8; weight 8 oz. Basal length of skull 1·9, extreme length 2·15, zygomatic breadth 1·25.

Distribution. The province of Martaban in Burma, ranging north to the southern border of the Karennee country.

This form doubtless passes into *S. pygerythrus*, as in some skins the characteristic dark lateral bands are indistinct.

248. **Sciurus pygerythrus.** *The Irrawaddy Squirrel.*

Sciurus pygerythrus, *Geoffroy, Mag. Zool.* 1832, Cl. 1; *Bélanger, Voyage, Zool.* p. 145, pl. 7 (1834); *Blyth, J. A. S. B.* xvii, p. 345, xxiv, p. 475, xxxi, p. 333; *id. Cat.* p. 103; *id. Mam. Birds Burma*, p. 37; *Anderson, An. Zool. Res.* p. 227.
Sciurus blanfordi, *Blyth, J. A. S. B.* xxxi, p. 333, xxxii, p. 73; *id. Cat.* p. 104; *id. Mam. Birds Burma*, p. 36; *Anderson, An. Zool. Res.* p. 230.

Colour above speckled olive-brown to grey, below light rufous or buff. Feet sometimes buff like the lower parts, sometimes not. Dorsal hairs leaden black at the base, then white or isabelline and black alternately, usually two rings of each, the tips black. Tail coloured like the back, except the tip, which is black and well defined; tail-hairs annulated, with about four rings of each colour, whitish and black.

Dimensions. Head and body about 9 inches, tail without hair rather less; basal length of skull 1·75, extreme length 2·05, zygomatic breadth 1·25.

Distribution. Throughout the Irrawaddy valley in places from the neighbourhood of Rangoon, where it is common, to above Ava.

Varieties. S. blanfordi, the Ava and Upper Burma race, appears to be only a greyer form of the more olivaceous *S. pygerythrus* of Pegu.

249. Sciurus caniceps. *The golden-backed Squirrel.*

Sciurus caniceps, *Gray, A. M. N. H.* x, p. 263 (1842); *Blyth, Mam. Birds Burma*, p. 36; *Anderson, An. Zool. Res.* p. 229; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 161; *Thomas, P. Z. S.* 1886, p. 68.
Sciurus chrysonotus, *Blyth, J. A. S. B.* xvi, p. 873, pl. xxxvii, fig. 1, xxiv, p. 474; *id. Cat.* p. 103; *Peters, P. Z. S.* 1866, p. 429.
Sciurus concolor, *Blyth, J. A. S. B.* xxiv, p. 474; *id. Cat.* p. 103.

Two pairs of mammæ, one ventral and one inguinal, as in all allied forms. Feet very broad. Soles of all feet bearing granular tubercles between the pads.

Colour above speckled greyish olive to rufous olive, the back in the typical form changing in winter to orange or pale ferruginous red. The dorsal hairs are blackish at the base, and in the grey or olive (summer) phase the terminal portion is alternately yellow and black, 2 rings of each, the tip being black. In the orange (winter) phase all the terminal portion is orange. Head frequently pale grey. Lower parts speckled grey or olivaceous grey, often with a median dark line. In Southern specimens the flanks and sides of the neck are bright rufous. Tail indistinctly annulated, each hair coloured alternately whitish and black, usually about 4 rings of each; tip of the tail for about 2 to 3 inches black.

Dimensions of a female: head and body 8·7 inches, tail without hair 9·8, with hair 12·1, hind foot 1·2, ear 0·5. In a male the tail, without hair, is shorter than the head and body. Basal length of skull 1·95, extreme length 2·3, zygomatic breadth 1·35.

Distribution. From the neighbourhood of Moulmein, throughout the Tenasserim provinces and Malay Peninsula. Rare in Amherst.

Varieties. Two forms are included under this species, because in the ordinary summer vesture they are indistinguishable; as, however, one has a distinct breeding livery and the other has not, it is doubtful whether the two should not receive different names. These forms are:—

1. Typical *S. caniceps* (*S. chrysonotus*, Blyth), the form found in Northern Tenasserim near Moulmein. This is paler and greyer than the next variety, and both sexes in winter have the back orange. Mr. Thomas has shown, from the examination of a large series of dated specimens, that the yellow colour of the back begins to appear in patches about October, and to disappear and be replaced by grey hair about March.
2. *S. concolor*, found in Southern Tenasserim and the Malay Peninsula. This is darker in colour, both above and below, and has no seasonal change. Malay Peninsula skins have the sides of the neck and flanks rufous.

Habits. Probably precisely the same as those of all the allied forms. Beavan found the nest of this squirrel in July with one young one in it, and observed that the species occurs at times near houses, and occasionally descends to the ground to feed, but never remains there long. The breeding-time apparently is in the spring.

250. **Sciurus griseimanus.** *The grey-footed Squirrel.*

Sciurus griseimanus, *A. Milne-Edwards, Rev. Mag. Zool.* xix, p. 195 (1867); *Anderson, An. Zool. Res.* p. 233.

Colour speckled greyish brown above; dorsal hairs leaden black at the base then whitish and black alternately, two rings of each. Feet and lower parts pale isabelline or pale fawn. Tail coloured like the back, lower surface near the base the same colour as the abdomen, occasionally a small black tail-tip; tail-hairs generally with 4 or 5 rings of each colour, isabelline and black.

Dimensions of type: head and body 10 inches, tail the same; of Burmese skins apparently somewhat less.

Distribution. Cochin China and Cambodia. A single specimen has been procured by Mr. L. Fea at Kyouk Myoung, Upper Burma.

This squirrel is nearly allied to both *S. locroides* and *S. pygerythrus*, and evidently passes into both.

251. **Sciurus locroides.** *The hoary-bellied Himalayan Squirrel.*

Sciurus lokroides, *Hodgson, J. A. S. B.* v, p. 232 (1836); *McClelland, P. Z. S.* 1839, p. 152; *Blyth, J. A. S. B.* xvi, p. 873, xxiv, p. 475; *id. Cat.* p. 104; *Jerdon, Mam.* p. 169; *Anderson, An. Zool. Res.* p. 247.
Sciurus locroides, *Hodgson, J. A. S. B.* x, p. 915.
Sciurus assamensis, *McClelland, apud Gray, List Mam. B. M.* p. 143 (1843), no description; *Blyth, J. A. S. B.* xxiv, p. 475; *id. Cat.* p. 103; *id. Mam. Birds Burma*, p. 37.
Sciurus blythii, *Tytler, A. M. N. H.* ser. 2, xiv, p. 172 (1854).
Sciurus lokrioides *and* Macroxus similis, *Gray, A. M. N. H.* (3) xx, pp. 274, 281.

Snout short. Teeth larger than in *S. locria.* The length of the upper 5 molars together is about two thirds of that of the nasal bones. Usually two pairs of mammæ, more rarely three pairs, all ventral or inguinal.

Colour of upper parts, head, body, and tail speckled olive or yellowish brown, sometimes greyish brown, sides very little paler; feet the same as the sides; lower parts isabelline or greyish or pale rufous, more rarely light rufous-brown, sometimes speckled and occasionally with a faint median band. The colour of the abdomen passes gradually into that of the sides. Dorsal hairs leaden black at the base, then alternately yellow or whitish and black, generally two rings of each colour, the tip black; tail-hairs with about four rings of each colour. The terminal hairs of the tail have sometimes longer black tips than the others, but there is never a distinct black tail-tip. Some of the abdominal hairs are occasionally annulated. There is sometimes a rufescent tinge on the sides of the body and neck.

Dimensions. Head and body 8 inches, tail without hair 7·5, with hair 9·5; weight 8 oz. Basal length of skull 1·75, extreme length 2, zygomatic breadth 1·2.

Distribution. The Eastern Himalayas, Nepal, Sikhim, and Bhutan at low elevations, Assam and the Assam hills, Cachar, Tipperah, Chittagong, Manipur, and Arrakan; also Eastern Bengal (Dacca), Upper Burma (Bhámo), and Preparis Island.

Varieties. The form called *S. assamensis* is scarcely distinguishable from typical *S. locroides.* There is, however, a well-marked variety found in Sikhim and further east, with the anterior surface of the thighs richly fulvous, lower parts generally grey. This is *Macroxus similis* of Gray. Anderson says that a jet-black squirrel found in Sylhet and Cachar is probably referable to the present species.

S. locroides appears to pass into *S. griseimanus* and also, I believe, into the Chinese *S. castaneoventris* through forms of the latter with little or no chestnut on the lower parts.

252. **Sciurus atridorsalis.** *The black-backed Squirrel.*

Sciurus atrodorsalis, *Gray, A. M. N. H.* x, p. 263 (1842); *Blyth, J. A. S. B.* xvi, p. 872, pl. xxxvii, fig. 3, xvii, p. 345, xxiv, p. 477, xxviii, p. 276, xxxi, p. 333; *id. Cat.* p. 105; *id. Mam. Birds Burma,* p. 36; *Peters, P. Z. S.* 1866, p. 428; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 159; *Anderson, An. Zool. Res.* p. 233; *Thomas, P. Z. S.* 1886, p. 70.

Sciurus hyperythrus, *Blyth, J. A. S. B.* xxiv, p. 474; *id. Cat.* p. 102.

Foot broad; sole smooth, not granulated between the pads. Two pairs of mammæ, ventral and inguinal.

Colour very variable. The upper surface speckled greyish or rufous brown, with generally, but not always, an elongate black patch in the middle of the back. In rufous specimens the head is distinctly ferruginous red. Dorsal hairs black at the base, then alternately yellow and black, two rings of each (or occasionally only one ring); the black hairs of the patch in the middle of the back are sometimes black throughout, sometimes have one pale ring and a long black tip. Lower parts, as a rule, chestnut or bay, but there is much variation as to the extent, the throat and breast being often coloured like the sides, speckled greyish, and occasionally the whole under surface is buff. In some skins the breast and a band in the middle of the chestnut belly are speckled greyish, as in the *S. gordoni* form of *S. erythræus.* Tail, as a rule, subannulate, the hairs being alternately ringed with isabelline and black, about 4 rings of each, but at times there are long pale or rufous tips to the hairs, and in some skins the hairs are chiefly or entirely rufous white, in others black with rufous tips. Vibrissæ white, white mixed with black, or black.

Dimensions. Head and body 8·5 inches, tail without hair 7·4, with hair 10, hind foot without claws 1·8; extreme length of skull 1·95, basal length 1·7, zygomatic breadth 1·2.

Distribution. Northern Tenasserim, from considerably north of Moulmein to Tavoy. Common in Amherst. Not known certainly to occur further south. Some specimens have been procured in Lower Pegu.

Varieties. The excessive variability of this form in colour will be seen from the description. The pale lower surface in some skins may be due to immaturity, but the presence or absence of a black patch on the back does not appear to be connected with age, sex, or season, so far as is known. Moulmein specimens appear always to have white vibrissæ; a large collection of skins from Myawadi, 65 miles north of Moulmein, have black vibrissæ, but all the latter have black backs. *S. hyperythrus* of Blyth is a very rufous variety without either black dorsal patch or white whiskers.

Habits. Tickell in his MS. notes states that this squirrel is more common in bushes and hedges near villages, clumps of bamboos and thickets, than in high forest. It has a low cackling cry, and makes a grunting noise when alarmed.

253. **Sciurus palmarum.** *The Palm-Squirrel, or common striped Squirrel.*

Sciurus palmarum, *L. Syst. Nat.* i, p. 86 (1766); *Elliot, Mad. Jour. L. S.* x, p. 216; *Blyth, J. A. S. B.* xvi, p. 874; *id. Cat.* p. 106; *Jerdon, Mam.* p. 170; *Anderson, An. Zool. Res.* p. 257.
Sciurus penicillatus, *Leach, Zool. Misc.* i, p. 6, pl. i (1814); *Horsfield, Cat.* p. 152.
Funambulus indicus, *Lesson, Illust. Zool.* pl. xliii (1832).
Sciurus brodei, *Blyth, J. A. S. B.* xviii, p. 602, xx, p. 166, xxi, p. 350; *Kelaart, Prod.* p. 53.
Sciurus kelaarti, *Layard, Blyth, J. A. S. B.* xx, p. 166; *id. A. M. N. H.* (2) ix, p. 336 (1852); *Kelaart, Prod.* p. 53.

Gilehri, H.; *Berál, Lakhi*, Beng.; *Tidra, Tu*, Kol.; *Khadi*, Mahr.; *Alalu*, Can.; *Urta, Wadar, Vodatu*, Tel.; *Chitta Anathan*, Tam.; *Lena*, Cingalese.

Ears covered with short hair. Tail with long hair throughout. Fur short. Naked sole of hind foot not extending quite to heel. Outer posterior pad of hind foot broadly oval, anterior to end of long inner pad. Two pairs of mammæ, ventral and inguinal.

Colour of back finely speckled brown, varying from greyish or rufescent to almost black, with three well-marked whitish isabelline or pale rufescent longitudinal stripes from the back of the neck to the rump, the middle stripe extending sometimes on to the base of the tail. All three stripes are about $\frac{1}{8}$ to $\frac{1}{4}$ inch broad and subequal. Dark dorsal hairs black, with usually one pale rufous or isabelline subterminal ring. Head paler than back. Sides paler than back and frequently similar in colour to the pale dorsal stripes; the lateral border of the dark dorsal area sharply defined, so that the back may be considered as bearing 4 broad dark longitudinal bands, the two outer narrower than the two inner. Lower parts white, whitish or grey, the hair dusky at the base. Tail blackish or hoary, the hairs either whitish or rufous with two black rings, the more distal generally much the longer; tips of hair always whitish.

Dimensions. Head and body 5·5 to 6 inches, tail with hair rather more, hind foot 1·5; basal length of skull 1·35, extreme length 1·55, zygomatic breadth 0·9.

Distribution. Common throughout India and Ceylon in the more open and cultivated parts, especially near human habitations. Not found on the Malabar coast, nor east of the Bay of Bengal, nor in forest. To the west this squirrel extends into Sind and Baluchistan, though rare in both.

Habits. This is one of the commonest and best known animals of India, and of all wild mammals, in great part from its diurnal habits, it is perhaps the most familiar. It is commonly found in groves and gardens, and in avenues of trees along roads, especially on large banyan and pipal trees, and though often seen on palms, it is by no means particularly partial to them. It is very commonly seen feeding on the ground about trees, very rarely away from them, and it takes refuge in the branches when alarmed. It also very commonly inhabits the rafters and thatch of houses and enters rooms freely. From its abundance about cultivation and houses and from its not being found in forests, this species is probably a follower or "commensal" of the human race, as *Mus rattus*, *M. decumanus*, and *M. musculus* certainly are; and *S. palmarum* may be the semi-domesticated form of *S. tristriatus*, just as Mr. Dobson has suggested that *Crocidura cærulea* is of *C. murina*.

The food, as with other squirrels, consists of seeds, fruits, buds, &c., and according to McMaster of insects also. I have, I think, seen this species eat the flying termites or white-ants. McMaster says *S. palmarum* is said to destroy birds' eggs; but this he doubts, on the very reasonable ground that a nest robber would in the breeding-season cause much excitement among the small birds with which the squirrel lives on perfectly friendly terms. However, as Sterndale justly remarks, *S. vulgaris* is commonly accused of the same propensity in Europe. The cry of the palm-squirrel is a shrill chirp, resembling the note of a bird. The little animal is very easily tamed, having originally little or no fear of man.

The female has, according to Jerdon, two to four young at a birth. It constructs a rough bulky nest, of grass, wool and any fibrous matter it can obtain, in the branches of trees, or sometimes in the eaves or rafters of houses.

Blyth and Jerdon classed the small rufous striped squirrels, *S. brodei* and *S. kelaarti*, as varieties of the next species, which they thought replaced *S. palmarum* in Ceylon; but unless these small broad-striped forms from Ceylon, of which there are many specimens in the British Museum, are classed with *S. palmarum*, it is impossible to keep *S. tristriatus* distinct. Some of the Indian varieties with dark back and the tails rufous beneath, referred by various writers to *S. tristriatus*, must also be united to *S. palmarum*, if the two are kept separate.

254. **Sciurus tristriatus.** *The jungle striped Squirrel.*

Sciurus tristriatus, *Waterhouse, Charlesworth's Mag. Nat. Hist.* i, p. 499 (1837); *id. P. Z. S.* 1839, p. 118; *Blyth, J. A. S. B.* xvi, pp. 874, 1001, xviii, p 601; *id. Cat.* p. 106; *Kelaart, Prod.* p. 51; *Jerdon, Mam.* p. 171; *Anderson, An. Zool. Res.* 258.

Sciurus (Tamias) dussumieri, *A. Milne-Edwards, Rev. Mag. Zool.* xix p. 226 (1867).

Anan, Mal. Other Indian names same as those of the last species.

Structure as in the last except that the skull is broader in pro-

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portion and the nose more produced. Colour very similar but darker; the back is black or blackish brown, with three *narrow* longitudinal white or whitish subequal stripes, not more in general than $\frac{1}{16}$ inch in width, and usually not extending so far back as the root of the tail. Head rufous above, sides greyish brown, belly whitish or grey; tail-hairs deep rufous, with black rings and a white tip.

Dimensions. Head and body 7·5 inches, tail without hair 6·25, with hair 7·5; basal length of skull 1·6, extreme length 1·8, zygomatic breadth 1.

Distribution. Throughout a great part of the peninsula of India and Ceylon, in forest regions. Anderson records this species also from Sikhim. Common in Malabar.

Habits. The voice is said by both Blyth and Jerdon to be quite different in character from that of *S. palmarum* and much less shrill. Although generally a denizen of the woods, this species has been known to enter and inhabit houses in places where the palm-squirrel does not occur, and a case is mentioned by Jerdon as occurring in his own house at Tellichery.

I feel much doubt as to the distinctness of this form from *S. palmarum*, which I suspect, as mentioned under that species, to be a semi-domesticated variety.

255. **Sciurus layardi.** *Layard's striped Squirrel.*

Sciurus layardi, *Blyth, J. A. S. B.* xviii, p. 602; *id. Cat.* p. 107; *Kelaart, Prod.* p. 53; *Layard, A. M. N. H.* (2), ix (1852), p. 335; *Jerdon, Mam.* p. 172; *Anderson, An. Zool. Res.* p. 260.

Colour above dark brown, faintly speckled; back blackish with three longitudinal pale bands, that in the middle orange or buff-coloured, well marked, running the whole length of the back, the lateral bands brownish, fainter and shorter. Dorsal hair black, with one small orange ring near the tip. Lower parts deep rusty red, hairs dusky at the base. Tail hoary above, ferruginous below. Basal half of caudal hair rather more rufous with one narrow black ring, terminal half black with whitish tips.

Dimensions. About the same as *S. tristriatus* or rather larger.

Distribution. The mountainous parts of Ceylon, and also, according to Jerdon, of Travancore.

Habits. A forest animal, like *S. tristriatus*, of which this may prove to be a variety.

256. **Sciurus sublineatus.** *The dusky striped Squirrel.*

Sciurus sublineatus, *Waterhouse, P. Z. S.* 1838, p. 19; *Blyth, J. A. S. B.* xvi, p. 875; *id. Cat.* p. 107; *Jerdon, Mam.* p. 173; *Anderson, An. Zool. Res.* p. 260.
Sciurus delesserti, *Gervais, Mag. Zool.* 1842, pl. 31.
Sciurus trilineatus, *Waterhouse, Blyth, J. A. S. B.* xx, p. 165 (1851); *Kelaart, Prod.* p. 54.

Size small. Naked sole of hind foot not extending quite to heel; outer posterior pad of hind foot oval, short, more distal in position than the long linear inner pad. Fur soft and dense.

Colour. Upper parts dull brown, finely speckled; middle of back deeper brown, with three indistinct narrow pale lines, closer together and shorter than in *S. palmarum* and its allies, and only extending in general from behind the shoulder to the loins. Dorsal hair leaden black at the base, then jet-black, with one or two whitish or orange rings. Lower parts pale brown, more or less rufescent, or dull grey. Tail-hairs with alternating orange or whitish and black rings of subequal length, 3 or 4 of each colour.

Dimensions. Head and body 5 inches, tail with hair rather more, hind foot 1·2; zygomatic breadth of skull 0·7.

Distribution. The mountains of Southern India, Wynaad, Nilgiri, Palni, Travancore &c., and Ceylon. Found as far north as Coorg. Not recorded from the Shevaroys. According to Kelaart this squirrel is not found in Ceylon below 3000 ft. elevation.

This also is a forest animal, but, despite its stripes, has probably but little affinity with *S. palmarum* and its allies.

257. Sciurus macclellandi. *The striped Himalayan Squirrel.*

Sciurus macclellandi, *Horsfield, P. Z. S.* 1839, p. 152; *Blyth, J. A. S. B.* xvi, p. 875; *id. Cat.* p. 107; *Jerdon, Mam.* p. 173; *Anderson, An. Zool. Res.* p. 263; *Thomas, P. Z. S.* 1886, pp. 61, 71.
Sciurus pembertoni, *Blyth, J. A. S. B.* xi, p. 887.
Sciurus barbei, *Blyth, J. A. S. B.* xvi, p. 875, pl. xxxvi, f. 3 (1847); *id. Cat.* p. 107; *id. Mam. Birds Burma*, p. 38; *Blanford, J. A. S. B.* xl ii, pt. 2, p. 164.
Sciurus macclellandi, var. swinhoei, *M.-Edw. Rech. Mam.* p. 308.

Ears covered outside with long hair forming a pencil. Tail with long hair below, but less bushy than in most squirrels. Three pairs of mammæ, ventral and inguinal, the anterior pair nearer to the axil than to the groin.

Colour of upper parts dull greyish brown lighter or darker; a well-marked black stripe down the middle of the back with a pale band, ill-marked in Northern specimens, on each side; outside this again is a broad dark band, brown in Himalayan specimens, black in Tenasserim; again outside this is a broad pale buff or whitish band extending from the muzzle down each side of the head, neck, and body, and in some Tenasserim skins this pale band has an outer black border. Dorsal hairs black at the base. Hair on outside of ears black, the hairs on the tips of the ears with long white terminations. Lower parts varying from whitish or pale brown to buff or pale rufous or dull grey. Tail with alternating rufous, whitish, and black rings, usually rufous at the base, then black, then rufous, then a long subterminal black space and a whitish tip.

Dimensions. Head and body 4·5 to 5 inches, tail without hair 3·75 to 5, with hair 5 to 6, hind foot from heel 1·1. Weight about 2·5 oz. A Sikhim skull measures in extreme length 1·35, basal length 1·1, zygomatic breadth 0·8.

Distribution. Found in Sikhim and the Eastern Himalayas, extending eastward into China and as far as Formosa, also in the Assam hills, Cachar and Manipur, throughout the Tenasserim provinces and the Malay peninsula (I possess a specimen collected by Mr. Davison and labelled Malacca), and in Siam and Cochin China. I cannot find this species recorded from Arrakan or Pegu, nor was it obtained by Hodgson at Katmandu in Nepal. All his specimens apparently were from Darjiling.

Varieties. Two very distinct races occur within our area:—

1. Typical *S. macclellandi*, from the Eastern Himalayas, has but one black line on the back, in the middle, and only two distinct pale stripes, one on each side.
2. *S. barbei*, from Tenasserim, is altogether more brightly coloured and has four distinct buff stripes on the back, two on each side, and either 3 or 5 black stripes. Skins from Manipur are intermediate between the two races, and Chinese specimens (*S. macclellandi*, var. *swinhoei*) are duller in colour than Himalayan.

Habits. This squirrel is found in high forest, and, so far as is known, but rarely descends to the ground.

258. **Sciurus berdmorei.** *Berdmore's Squirrel.*

Sciurus berdmorei, *Blyth, J. A. S. B.* xviii, p. 603 (1849), xxviii, p. 418; *id. Cat.* p. 106; *id. Mam. Birds Burma*, p. 37; *Anderson, An. Zool. Res.* p. 261; *Thomas, P. Z. S.* 1886, p. 71; *Anderson, Fauna Mergui Arch.* i, p. 340.

Sciurus mouhoti, *Gray, P. Z. S.* 1861, p. 137; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 162.

Muzzle long and narrow. Ears well clad. Tail with long hair beneath. Soles of the hind feet bare to the heel, and smooth, not tuberculated; the outer posterior pad is linear, but anterior in position to the long inner posterior pad. Three pairs of mammæ, ventral and inguinal.

Colour above brown, finely speckled, rufescent on the back, yellower or greyer on the sides. There are two pale yellowish or whitish longitudinal bands on each side; the upper narrower and better defined than the lower. Between the two and above the upper pale band, the fur is darker as a rule and sometimes blackish, and occasionally there is a short black band in the middle of the back. Dorsal fur dusky at the base, then alternately orange and black, usually two rings of each, the tip black. Lower parts white, sometimes tinged with buff. Tail blackish, rendered hoary by the white tips, sometimes indistinctly annulated; hairs light brown or rufous at the base, then black, then rufous again, then for a considerable length black, to near the tips which are whitish.

Dimensions. Head and body 7 inches, tail without hair 5·5, with hair 7·5, hind foot 1·5; extreme length of skull 2.

Distribution. Martaban and Tenasserim, Mergui Archipelago, Cambodia and Cochin China.

Habits. This is said to be chiefly a ground squirrel, and Blyth doubts if it ever ascends trees. Probably, however, its habits are not unlike those of *S. palmarum*. It is said to be found about cultivation.

Subfamily ARCTOMYINÆ.

The marmots, of which this subfamily is composed, are Palæarctic and Nearctic, and comprise three genera, *Arctomys*, *Spermophilus*, and *Cynomys*. Only the first of these, distinguished from the others by the want of cheek-pouches, is represented in the Himalayas within our limits. All the members of this subfamily are burrowers, and live in holes in the ground. Some inhabit mountains, others open plains.

Genus **ARCTOMYS**, Schreber (1792).

Form stout, tail short or moderate, ears very small. Thumb rudimentary.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$, as in *Sciurus*. Incisors not compressed. Anterior upper premolar larger than in squirrels, but still much smaller than the second; molars broad.

Synopsis of Indian Species.

Tail less than $\frac{1}{3}$ head and body; colour greyish.	*A. himalayanus*, p. 388.
Tail about $\frac{1}{3}$ head and body; colour greyish ..	*A. hodgsoni*, p. 389.
Tail fully $\frac{1}{2}$ head and body; colour yellow ..	*A. caudatus*, p. 390.

259. **Arctomys himalayanus.** *The Tibet Marmot.*

Arctomys himalayanus, *Hodgson, J. A. S. B.* x, p. 777, plate (1841), xi, p. 287; ("*potius tibetensis hodie*") xii, p. 409; *Blanford, J. A. S. B.* xliv, pt. 2, p. 121; *id. Yarkand Miss., Mam.* p. 36, pls. xii, xii *a*; *Lydekker, J. A. S. B.* xlix, pt. 2, p. 7; *Büchner, Przewalski Reis., Säugeth.* p. 25.

Arctomys bobac, *Gray, List Mam. B. M.* 1843, p. 148, partim; *Blyth, Cat.* p. 108, partim; *Jerdon, Mam.* p. 181, partim; *Stoliczka, J. A. S. B.* xxxiv, p. 111; *Anderson, P. Z. S.* 1871, p. 560.

Arctomys tibetanus, *Adams, P. Z. S.* 1858, p. 521.

Brin, Kashmir; *Pfif*, Niti; *Kadia-piu*, *Phya*, Tibetan; *Chibi*, Bhotia of Sikhim.

Tail about $\frac{1}{4}$ the length of the head and body. Six pairs of mammæ, extending from the axil to the groin.

Colour of body and limbs pale tawny, much mixed with black on the upper parts; basal half of fur (basal third on belly) dark brown, terminal half pale fulvous, with black tips on the upper parts; face and terminal third of tail dark brown; cheeks sometimes rufescent.

GSL

Dimensions. Head and body 22 to 24 inches, tail without hair 5 to 5·5, with hair 6 to 6·5, hind foot 3·25; basal length of skull 3·85, extreme length 4·1, zygomatic breadth 2·6.

Distribution. Tibet north of the main Himalayan chain, from the neighbourhood of Lhassa to Ladák and the Kuenlun. Common in Rukshu and Ladák at elevations of from about 13,000 or 14,000 feet to 18,000. This species was also obtained in Northern Tibet by Przewalski.

Habits. This marmot inhabits the bleak dry plateau of Tibet in colonies, its burrows being most commonly found on the sides of valleys. It lives on roots and vegetables, coming out to feed in the morning and evening; it doubtless hibernates in the winter. The alarm cry is "a short chirping bark" according to Lydekker. Marmots are easily tamed, and the present species is no exception.

260. **Arctomys hodgsoni.** *The smaller Himalayan Marmot.*

Arctomys hemachalanus, *Hodgson, J. A. S. B.* xii, p. 410 (1843); *Jerdon, Mam.* p. 182; *Blanford, J. A. S. B.* xliv, pt. 2, p. 122; *nec* A. himalayanus, *Hodgson.*

Arctomys tibetanus, *Gray, Cat. Mam. &c. Nepal & Tibet,* 1846, p. 24; *id.* 2nd ed. p. 12; *nec* A. tibetensis, *Hodgson.*

Arctomys bobac, *Blyth, J. A. S. B.* xvi, p. 875, partim; *id. Cat.* p. 108, partim, *nec Schreber.*

Arctomys hodgsoni, *W. Blanford, Yarkand Miss., Mam.* p. 35; *id. P. Z. S.* 1880, p. 453.

Jabra, Bhotia.

Tail about a third as long as the body and head. Five or six pairs of mammæ.

Colour almost identical with that of *A. himalayanus*, tawny, the dorsal fur dusky at the base and black-tipped, bridge of nose and end of tail dark brown. Sides of head, ears, and limbs rufous, especially in summer.

Dimensions. Head and body 12 to 13 inches, tail 5½, hind foot nearly 3. I believe these measurements, which are Hodgson's, are too small, and that the species grows to 16 or 18 inches from nose to vent. An adult skull measures 3·7 in extreme length, 2·4 in zygomatic breadth.

Distribution. Nepal, Sikhim, and Bhutan; probably Cis-Himalayan, whilst *A. himalayanus* is Trans-Himalayan.

Nothing is known of this species except in confinement. I have never seen the skin of a wild specimen, nor, I believe, has one been recorded, although there are, at present, no less than fifteen specimens in the Indian Museum, Calcutta, and this marmot is apparently far from rare in Sikhim. Hodgson had both this and *A. himalayanus* in confinement. The name *hemachalanus*, being identical with *himalayanus*, cannot be employed.

261. **Arctomys caudatus.** *The red or long-tailed Marmot.*

Arctomys caudatus, *Jacquemont, Voyage dans l'Inde,* iv, p. 66; *Atlas,* ii, pl. 5 (1844); *Blanford, J. A. S. B.* xliv, pt. 2, p. 122; *id. Yarkand Miss., Mam.* p. 37, pls. xiii, xiii *a*; *Lydekker, J. A. S. B.* xlix, pt. 2, p. 7; *Scully, P. Z. S.* 1881, p. 204; *id. A. M. N. H.* (5) viii, p. 98.

Arctomys bobac, *Adams, P. Z. S.* 1858, p. 521; *Blyth, Cat.* p. 108, partim, *nec Schreber.*

Arctomys hemachalanus, *Anderson, P. Z. S.* 1871, p. 561, *nec Hodgson.*

Drun, Kashmir.

Tail about half the length of the head and body.

Colour yellowish tawny to orange, the back chiefly black, sometimes wholly black, in the middle, the hairs being black throughout; usually the dorsal fur is blackish at the base, then tawny and with long black tips. Face brown, blackish round the eye; tail black at the tip and usually for a considerable portion of the length, tawny towards the base. Lower parts and limbs brownish rufous, deeper in some examples than in others. The general tint is more rufous than in the other Himalayan species and the back is blacker.

Dimensions. Head and body about 2 feet, tail with hair 12 to 13 inches, hind foot 3·4; basal length of skull 4·1, extreme length 4·2, zygomatic breadth 2·6. Specimens from Astor appear smaller.

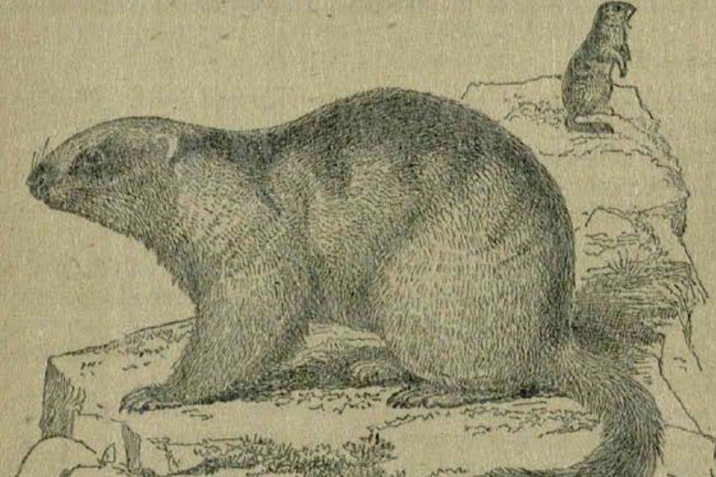

Fig. 124.—*Arctomys caudatus.*

Distribution. The ranges immediately north of Kashmir proper from Wardwan to Deosai and Astor, at elevations between 8000 and 14,000 feet. I can find no account of this marmot's occurrence east of Kashmir, nor is it found in Ladák except on the southern border.

Habits. Similar to those of *A. himalayanus* and other marmots. The call, however, is different; Adams describes it as a loud wailing cry, Lydekker as a long screaming whistle of great shrillness. *A. caudatus* inhabits comparatively fertile localities on the border of the dry region, and is found at a lower elevation than *A. himalayanus.*

Other Central-Asiatic species of marmot are *A. dichrous* from Northern Afghanistan, *A. aureus* from the mountains west of Yarkand, both allied to *A. caudatus* but smaller, and *A. robustus* from Eastern and North-eastern Tibet, allied to *A. himalayanus* but classed as distinct by Milne-Edwards and Büchner. A *Spermophilus*, *S. bactrianus*, has recently been described by Dr. Scully from Afghan Turkestan.

Family DIPODIDÆ.

The present subdivision is composed of the Asiatic and African jerboas, the North-American jumping mice (*Jaculus*), the Cape jumping hare (*Pedetes*), and a few other forms. As a rule they are distinguished by hind limbs of disproportionate length and a long hairy tail, and both in their form and mode of progression resemble kangaroos. They not only move quickly by jumping on their hind legs, but are said to use their tails to aid their movements.

The molars have transverse enamel-folds, the incisors are compressed. The brain-case is short and broad, the infraorbital opening rounded and very large, the zygomatic arch slender and curved downwards, the malar ascending in front of the orbit to the lachrymal in a flattened perpendicular plate, the mastoid (supratympanic) part of the bulla generally greatly developed. The elongated metatarsals are united to form a cannon bone. Hind feet with but three functional digits. Cervical vertebræ more or less anchylosed.

A single species just enters the margin of the Indian area from Central Asia.

Genus **ALACTAGA**, F. Cuv. (1836).

Syn. *Scirtetes*, Wagner.

On the hind foot there are 5 toes, the first and fifth not reaching the ground. Tail long, cylindrical, tufted at the end. Ears long.

Dentition: i. $\frac{2}{2}$, pm. $\frac{1-1}{0-0}$, m. $\frac{3-3}{3-3}$. Incisors not grooved; premolars small, sometimes lost, two anterior molars in both jaws much larger than the third, and bearing external and internal enamel-folds that become loops with wear.

262. Alactaga indica. *The Afghan Jerboa.*

Alactaga indica, *Gray, A. M. N. H.* x, p. 262 (1842); *Hutton, J. A. S. B.* xv, p. 137; *Blanford, Eastern Persia,* ii, p. 77; *Sclater, P. Z. S.* 1880, p. 538.
Alactaga bactriana, *Blyth, Cat.* p. 110.
Khani, in Afghanistan.

The first and fifth toes of the hind foot are subequal, about 0·8 inch short of the middle toe, second and fourth toes 0·15 short. Toe-pads transversely grooved. Ears very long, exceeding the fore leg in length. Fur soft. Tail twice the length of the head and body.

Colour above fawn or light rufescent brown, sometimes mixed with black, becoming paler and more rufous on the sides; lower parts white, and a white band across the outside of each thigh, a black spot sometimes behind and inside the thigh just below the white band. Basal two-thirds or more of hair on the back ashy, light or dark, tips of hairs sometimes black. Tail light brown, the tuft of long hair at the end blackish brown except the tip, which is white.

Dimensions of a male: head and body 3·6 inches, tail without terminal hair 7, with terminal tuft 7·6, ear from crown of head 1·7, hind foot and tarsus 2·2; basal length of skull 1, zygomatic breadth 0·85.

Distribution. Afghanistan, South-eastern Persia, and Northern Baluchistan. Not uncommon on the plains south of Quetta at an elevation of about 6000 feet.

Habits. According to Hutton this jerboa is abundant in the stony plains of Afghanistan, burrowing deeply. When unearthed it bounds away with surprising agility on its hind legs. It is thoroughly nocturnal, sleeping soundly all day. It retires to its burrow in October and remains dormant till the following April. It is easily tamed. Major Money, who sent a living specimen to the Zoological Gardens, London, observed that this jerboa appeared not to require water in its natural state, though it drank in captivity. It fed on green wheat, rice, lucerne or maize, raw potatoes, gram or other grain, and dry biscuit.

The name given to this jerboa by Gray is very objectionable, as the species cannot be said to occur in India. Blyth's name *bactriana* is scarcely better. From the nearly allied *A. acontion*, Pallas, the present species is distinguished by its proportionally longer ears and tail.

Several other species of *Alactaga* and of *Dipus*, the latter having grooved incisors and only three toes on each hind foot, occur in Central Asia.

Family MURIDÆ.

This large and cosmopolitan family comprises the mice and rats, with a large number of allied forms. The following are the principal characters:—

Skull without postorbital processes. Infraorbital opening large, almost always wide above, and terminating below in a narrow groove, the outer wall of which is always a flattened plate, forming the lower root of the maxillary zygomatic process. Malar short and slender. Premolars none; dentition in all Indian genera i. $\frac{2}{2}$, m. $\frac{3-3}{3-3}$.

The number of subfamilies into which this family was divided by Peters and Alston (P. Z. S. 1876, pp. 69, 80), who have been followed by several writers, appears to me too large, and I cannot agree in placing *Nesocia*, which is barely distinguishable generically from *Mus*, in a distinct subfamily from the latter. At the same time, the classification of this extensive family is very difficult. The Indian forms may be thus classed, but the distinctive characters do not always apply to genera not found in India:—

A. Tail much more than $\frac{1}{3}$ total length, generally $\frac{1}{2}$ or more.	
a. Crowns of worn molars with oblique subparallel bands of enamel; tail with long coarse hair.................	*Platacanthomyinæ.*
b. Crowns of worn molars with transverse laminæ forming oval or lozenge-shaped patterns; tail hairy; hind legs elongate	*Gerbillinæ.*
c. Crowns of upper molars with 3 longitudinal rows of tubercles, lower with 2 rows (except in *Hapalomys*); worn molars with transverse enamel-bands curved or straight; tail naked or thinly clad, scaly	*Murinæ.*
B. Tail (in all Indian forms) less than $\frac{1}{3}$ total length; all molars either with tubercles in 2 longitudinal rows, or composed of subtrigonal prisms similarly arranged..	*Cricetinæ.*

As with other small mammals, the measurements are chiefly from specimens preserved in alchohol, and in these, especially if strong spirit has been used, the body contracts in length rather more than the tail, whilst membranous parts, such as the ears, shrink rather more in proportion than the body.

Subfamily PLATACANTHOMYINÆ.

Molars rooted, subequal in size, crossed by subparallel folds of enamel directed obliquely inwards and backwards. Anterior palatine foramina small, not extending back beyond the hinder margin of the premaxillaries. Auditory bullæ small. Coronoid process of mandible short. Tail long, hairy.

Genus **PLATACANTHOMYS**, Blyth (1859).

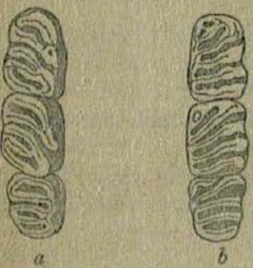

Fig. 125.—Crowns of (*a*) upper and (*b*) lower right molars of *P. lasiurus*, × 4.

Form resembling that of a dormouse. Tail clad with long coarse straight hairs, arranged distichously towards the tip. Pollex and hallux short, clawless (the latter may sometimes bear a nail). Skull broad, flattened above behind: a well-marked supraorbital ridge on each side. Infraorbital foramen very large. Bony palate broad, imperfect, perforate. Incisors smooth, narrow.

A single known species peculiar to the hills near the Malabar coast.

263. **Platacanthomys lasiurus.** *The Malabar spiny Mouse.*

Platacanthomys lasiurus, *Blyth, J. A. S. B.* xxviii, p. 288 (1859); *id. Cat.* p. 109; *Peters, P. Z. S.* 1865, p. 398, pl. xx; *Jerdon, Mam. Ind.* p. 210.

Ears large, pointed, posterior margin slightly concave below the tip. Vibrissæ numerous, several of them more than twice the length of the head. Fur of the upper parts mixed with broad flat spines having thickened edges. Tail hairy throughout, the hair coarse but not spiny, and subdistichous, short near the body and gradually increasing in length towards the tip of the tail. Five pads on each palma, and 7 or 8 on the planta, including one long inner metatarsal pad and two or three outer, behind each other, all but the first small. Claws overhung by hair. Mammæ one pair pectoral and one inguinal (Blyth gives 2 pairs abdominal).

Colour above reddish brown, below nearly white, the colours not passing into each other; dorsal fur white at the base and for three quarters of its length or more, tips above brown. Feet white or whitish. Tail coloured like the back above and below, the extremity sometimes whitish.

Dimensions of an adult in spirit: head and body 4·5 inches, tail without hair 3·8, with hair 5, hind foot from heel 0·95, ear 0·8. Basal length of skull 1·05, extreme length 1·25, zygomatic breadth 0·7.

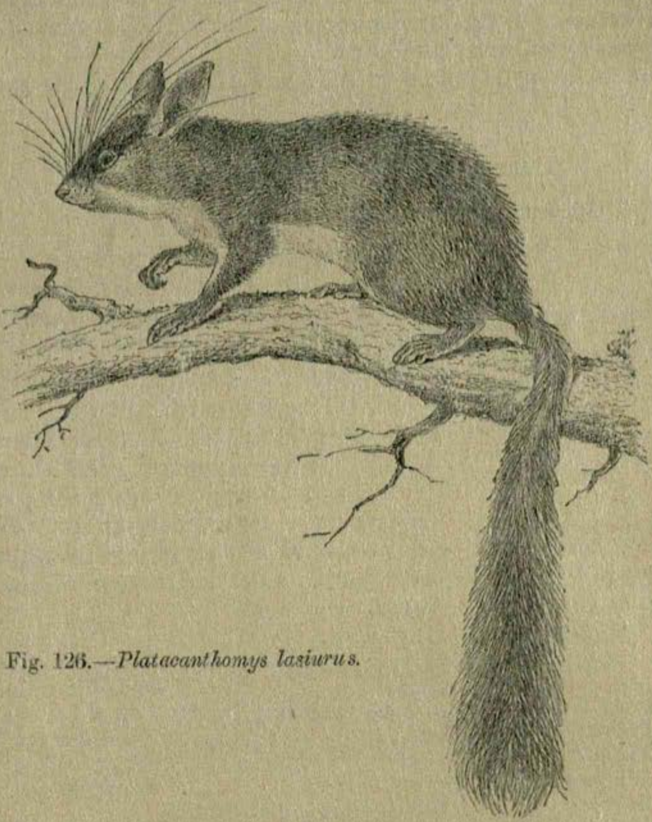

Fig. 126.—*Platacanthomys lasiurus.*

Distribution. Anaimalai and Travancore hills at elevations of more than 2000 feet above the sea. There is a specimen in the British Museum labelled Ootacamund, but I feel doubtful if the locality is correct. The species has not been recorded from Ceylon.

Habits. The Rev. H. Baker, who discovered *Platacanthomys*, informed Mr. Blyth that the species lived exclusively in large trees, in which these rats hollowed out little cavities that they filled with leaves and moss. They were said by the hill-people to destroy much pepper and to do serious damage to angely and jack fruit (*Artocarpus incisa* and *A. integrifolia*), also to be fond of fermented palm-juice or toddy.

Subfamily GERBILLINÆ.

Molars rooted, tubercular at first; when they are worn, the enamel forms transverse oval or lozenge-shaped patterns that after a time coalesce in the middle of the tooth. Auditory bullæ large. Hind limbs elongate; tail hairy.

This subfamily is found in Asia and Africa. A single genus is Indian.

Genus **GERBILLUS**, Desmarest (1804).

Syn. *Meriones*, Illiger (1811).

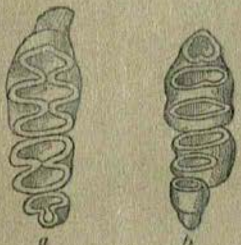

Fig. 127.—(*a*) Upper and (*b*) lower right molars of *G. indicus*, × 3.

Tail long, hairy, with a terminal pencil of long hair. Head slightly elongate, ears moderate. Mammæ 4 pairs: 2 pectoral, 2 inguinal. Large metacarpal pads.

Dentition: i. $\frac{2}{2}$, m. $\frac{3-3}{3-3}$. Upper incisors grooved longitudinally, anterior molar in both jaws composed of three transverse elliptical or lozenge-shaped areas, the second of two, and the third of one; the posterior upper molars with a more or less rudimentary second ridge or heel, soon disappearing with wear. Occipital region of the skull broad.

Synopsis of Indian and Ceylonese Species.

A. Size of a rat. Snout to vent exceeding 4 in.	
a. Planta entirely naked	*G. indicus*, p. 396.
b. Distal half of planta hairy; ear 0·25 in.	*G. hurrianæ*, p. 398.
c. Whole planta hairy; ear 0·45 in.	*G. erythrura*, p. 399.
B. Size of a mouse. Snout to vent less than 3·5 in.	
a. Planta with 6 pads, proximal half naked ..	*G. nanus*, p. 399.
b. Planta without distinct pads, hairy throughout	*G. gleadowi*, p. 400.

264. **Gerbillus indicus.** *The Indian Gerbille or Antelope Rat.*

Dipus indicus, *Hardwicke, Linn. Trans.* viii, p. 279, pl. vii (1807).
Gerbillus indicus, *F. Cuv. Tr. Z. S.* ii, p. 143, pl. xxv, figs. 15–19; *Blyth, J. A. S. B.* xxxii, p. 327; *id. Cat.* p. 110; *Jerdon, Mam.* p. 184; *Blanford, Eastern Persia*, p. 63.
Mus (Gerbillus) indicus, *Elliot, Mad. Journ. L. S.* x, p. 211.
Gerbillus cuvieri *and* G. indicus, *Waterhouse, P. Z. S.* 1838, p. 56.
Gerbillus cuvieri, *Hutton, J. A. S. B.* xv, p. 139.

Harna mús (antelope rat), H.; *Jhenku indúr*, Beng.; *Pándhará undir*, Mahr.; *Yeri yelka*, Wadári; *Tel yelka*, Yenadi; *Billa ilei*, Canarese.

Tail longer than head and body. Ears moderate, rounded, thinly clad. Planta naked, distal portion granular. Two pads at base of three middle toes, one inside the base of first and another inside the base of fifth toe, four in all. Eyes very large.

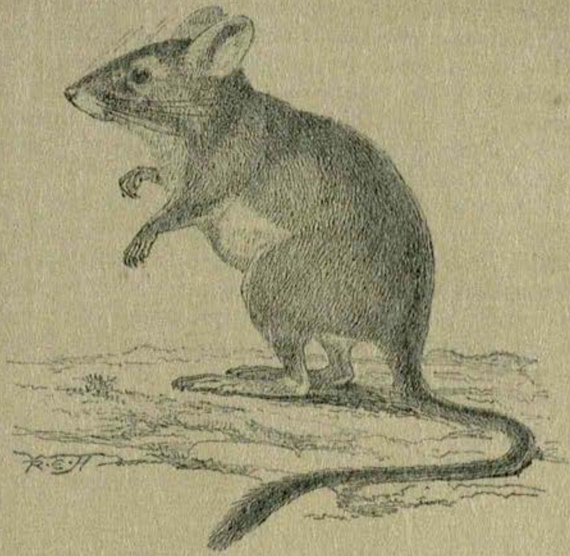

Fig. 128.—*Gerbillus indicus.*

Colour light brownish rufous, varying from sandy brown to fawn-colour above; lower parts white, the colours sharply divided at times (probably in summer fur only). Basal two-thirds or more of dorsal hair leaden grey, a few longer hairs on the back, especially towards the rump, with long black tips. Area above and behind the eye, a spot behind the ear, and the whole upper lip white. Tail with a light brown band down each side, above and below darker, the upper surface becoming blackish and clothed with longer hairs towards the end, which is tipped with a pencil of long dark hairs almost black. Feet whitish above. Planta pale or dusky.

Dimensions. Head and body 5 to 7 inches, tail 6 to 8½, hind foot 1·3 to 1·7, ear from head 0·55 to 0·7; weight about 6 ounces. Basal length of a skull 1·65, extreme length 1·85, zygomatic breadth 1.

Distribution. Throughout India and Ceylon in suitable localities, extending west into Baluchistan, but not east of the Bay of Bengal.

Varieties. The Southern Indian form, *G. cuvieri*, is more slender, with longer tail and limbs, the planta dusky, and the first hind toe more proximally situated. Some specimens from Northern India are, however, similar, and there appears to be a complete gradation into the stouter typical *G. indicus*, which is found throughout Northern India, Sind, Baluchistan, &c. In a typical male Madras specimen (*G. cuvieri*) the head and body measure 6·1 inches, tail 8·15, ear 0·7, hind foot 1·7; and in a Baluchistan male the corresponding dimensions are 5·9, 6·6, 0·7, and 1·4.

Habits. These have been described by Hardwicke, Elliot, and Jerdon. The Indian gerbille is thoroughly nocturnal and very rarely seen outside its hole by daylight. It inhabits uncultivated plains and sandy downs, very often on the borders of cultivation. Here it makes extensive burrows with numerous entrances, and large central chambers from half a foot to a foot in length, containing a bed of dried grass.

These rats feed upon roots and grass, especially *harayáli* (*Cynodon dactylon*), seeds and grain, and sometimes cause great damage to the crops. In 1878–79 they ravaged the grain-fields in the Deccan throughout several thousand square miles (Fairbank, J. A. S. B. xlviii, pt. 2, p. 143), cutting down jawári (*Holcus sorghum*) and bájri (*H. spicatus*) stalks and feeding on the grain, part of which they stored in their burrows.

The Indian gerbille can make bounds of four or five yards at a time, and, as McMaster relates, often eludes dogs by its activity, sometimes jumping over their backs. The female has 8 to 12 young at a birth, occasionally, it is said, even more.

265. **Gerbillus hurrianæ.** *The Indian desert Gerbille.*

Gerbillus indicus, *Hutton, J. A. S. B.* xv, p. 137, *nec Hardwicke.*
Gerbillus erythrourus, *Jerdon, Mam.* p. 185, *App.* p. iii, *nec Gray.*
Gerbillus hurrianæ, *Jerdon, ib.* p. 186; *Blanford, Eastern Persia,* ii, p. 68.

Tip of the nose projecting so as partly to cover the nostrils. Tail about equal to head and body. Ears small, rounded, hairy outside. Distal half of planta hairy, proximal half with a considerable naked area. Fur short. Transverse elliptical folds of anterior upper molar united in the middle at an early stage of wear. Bullæ very large. Eyes moderate.

Colour light brownish grey (sandy grey) above; sullied white below, the two colours passing into each other. Some skins are rufescent above. Basal half of dorsal fur dark brown or leaden black, tips of longer hairs, more numerous about rump, black. Tail all round nearly the same colour as the back, except towards the end, where the hairs are longer and black or dark brown. Face-markings indistinct. Feet brownish white above.

Dimensions. Head and body 5·5 to 6·75 inches, tail 5 to 6·5, with hair 5·75 to 7, ear from crown 0·25, hind foot 1. A skull measures: basal length 1·25, extreme length 1·4, zygomatic breadth 0·8.

Distribution. The dry regions of North-western India, Sind, the Punjab, and Western Rajputana, also Baluchistan and South Afghanistan up to about 4000 feet above the sea.

Habits. This gerbille abounds in sandy desert or semi-desert, and is particularly common in Sind and the Indian desert between the

Indus and Rajputana, where its holes are found everywhere, especially at the roots of bushes amongst the sand-hills. It is commonly seen out in the day, in the cold season at all events, and is by no means shy. It feeds on various seeds, especially the nuts of *Salvadora persica*, and on roots.

266. **Gerbillus erythrura.** *The Afghan Gerbille.*

Gerbillus erythroura, *Gray, A. M. N. H.* x, p. 266 (1842); *Hutton, J. A. S. B.* xv, p. 139; *Blanford, Eastern Persia*, ii, p. 70.

Nostrils partly covered by a fleshy pad. Tail about equal to the head and body. Ears rounded, moderate, hairy outside. Plantæ covered with hair except a narrow band along proximal part of inner margin. Fur soft, moderately long. Transverse folds of anterior upper molar united in the middle at an early stage of wear. Bullæ very large.

Colour light sandy brown above, white below, the two passing gradually into each other on the sides. Some specimens are pale rufous above. Basal two thirds of the dorsal hair dark ashy. A few long black-tipped hairs on the lower back. Feet sullied white above. A pale band above the eye, extending to the ear. Tail more or less rufous-brown, not banded, uniformly coloured all round to near the tip, when long blackish hair comes in at first above and afterwards throughout.

Dimensions. An adult male in spirit measures: head and body 4·75 inches, tail without hair 4·75, with hair 5·5, ear from head 0·45, hind foot 1·3. A skull measures: basal length 1·35, zygomatic breadth 0·95.

Distribution. Throughout an extensive area in Afghanistan and Southern Persia, keeping to considerable elevations. I shot specimens at Mehtarzai near Quetta, where the species was obtained by Hutton.

Habits. This species, like *G. hurrianæ*, makes its holes at the roots of bushes or in sandy banks and mounds, generally in semi-deserted tracts, but often near habitations. The animals may be seen out feeding at all hours of the day in the cold season.

267. **Gerbillus nanus.** *The little Gerbille.*

Gerbillus nanus, *W. Blanford, A. M. N. H.* (4) xvi, p. 312 (1875); *id. Eastern Persia*, ii, p. 72, pl. v, fig. 1.

Nostrils inferior in position, partly covered by the snout. Tail long, more than one and a half times the length of the head and body. Proximal half of planta smooth, naked; distal half granular, with scattered hairs and bearing three pairs of pads. Two metacarpal pads. Vibrissæ very long. Ears oval, thinly furred.

Colour pale fawn above, white below, the two colours blending. Dorsal hairs ashy grey for basal two thirds. Tail light brown

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above, becoming rather darker at the tip, but not black, white beneath, no light bands down the sides. Supercilium and sides of face in front of the eyes with most of the vibrissæ white.

Dimensions. Head and body 2·8 inches, tail without hair 4·45, with hair 4·85, hind foot 0·85, ear from orifice 0·45. A skull measures 1·05 in extreme length by 0·55 broad.

Distribution. I first procured this Gerbille west of Gwádar in Baluchistan and have since obtained it at Sukkur and at Laki near Sehwán in Sind. It appears rare. A very similar, probably identical, form is found in Arabia and on the Abyssinian coastland.

268. **Gerbillus gleadowi.** *The little hairy-footed Gerbille.*

Gerbillus gleadowi, *Murray, A. M. N. H.* (5) xvii, p. 246 (1886).

Nostrils inferior, partly covered by snout. Tail more than one and a half times the length of the head and body. Planta thinly covered with hair throughout; no distinct pads, an irregular swelling at the base of the toes. Palma swollen, hairy, with one large naked pointed metacarpal pad near the base of the rudimentary pollex. Ears well clad.

Colour rufous-fawn above, white below, the two colours well defined, basal two thirds of dorsal fur slaty. Tail almost uniform pale brownish, paler below, whitish near the tip; the terminal pencil brown above, white below. Supercilium, sides of face in front of the eyes, and all vibrissæ except the uppermost white; a rufous cheek-patch.

Dimensions. Head and body 3·25 inches, tail without hair 5, with hair 5·4, hind foot 1. Extreme length of skull 1·12, basal length 0·9, breadth 0·6.

Distribution. Rohri district, Upper Sind, is the only locality whence this Gerbille has hitherto been obtained.

Gerbillus swinhoei (Scully, A. M. N. H. (5) viii, p. 228, 1881) is rather larger than *G. gleadowi*, but much like that species, except that it has a very much shorter tail, the palma naked, and two metacarpal pads. Planta hairy throughout. Head and body 3·4 inches, tail without hair 3·1, with hair 3·5, hind foot 0·93. Found halfway between Kandahar and the Kojak Pass, and to be looked for around Quetta. Several species of *Gerbillus* inhabit Central and Western Asia and Africa, but none are found in Burma, the Malay Countries, or Southern China.

Subfamily MURINÆ.

Molars rooted, tubercular at first, the tubercles on the upper molars disposed in a triple row longitudinally. When worn the molars exhibit transverse laminæ of enamel. Tail elongate, scaly, and in general nearly naked.

The Indian genera are thus distinguished :—

A. Tubercles on anterior lower molars in 3 longitudinal series.. **Hapalomys.**
B. Tubercles on lower molars in 2 series.
  a. First and fifth digits of all feet with flat nails .. **Vandeleuria.**
  b. Pollex and hallux only with flat nails, crowns of molars deeply grooved longitudinally .... **Chiropodomys.**
  c. Pollex (thumb) only with a flat nail, other digits (except hallux in *Mus chiropus*) with compressed claws; crowns of molars not deeply grooved.
    a′. Upper incisors not grooved.
      a″. Dorsal fur wholly or chiefly composed of hair.
        α. Form slender; transverse laminæ of molars considerably curved.................... **Mus.**
        β. Form stout; laminæ nearly or quite straight **Nesocia.**
      b″. Back entirely covered with stout spines .. **Acomys.**
    b′. Upper incisors grooved longitudinally ...... **Golunda.**

Genus **HAPALOMYS**, Blyth (1859).

Hallux terminating in a broad tip bearing a flat nail. Each of the other digits (except the rudimentary pollex) swollen at the end into a lobe, which is deeply grooved longitudinally above, pitted at the anterior end of the groove, and transversely furrowed below to the end like the remainder of the digit. The claws, which are blunt and but little curved, apparently lie in the groove, especially in the fore feet, which have much shorter claws than the hind feet. In both, however, the tips of the digits project beyond the claws. Tail long, terminal portion flattened laterally. Skull with the nasals short, anterior border of zygoma-root vertical. Incisors smooth, lower incisors very broad: the two anterior molars in both jaws with tubercles arranged in 3 longitudinal series.

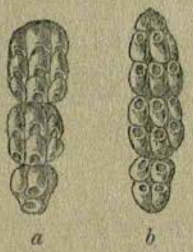

Fig. 120.—Crowns of (*a*) upper and (*b*) lower right molars of *H. longicaudatus*, ×3.

This genus, containing a single known species, differs from all other Muridæ in having the tubercles of the anterior lower molars triserially arranged.

269. **Hapalomys longicaudatus.** *Berdmore's Rat.*

Hapalomys longicaudatus, *Blyth, J. A. S. B.* xxviii, p. 296 (1859), xxxii, p. 353; *id. Cat.* p. 112; *id. Mam. Birds Burma*, p. 38.

Fur soft, dense and long. Tail much longer than the head and body, scaly and ringed, with short fine hair that becomes longer on the terminal third of the tail. Ears short, rounded, scantily clad with long hairs. Feet short. Foot-pads large, peculiarly marked

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with irregular concentric lines; both metatarsal pads elongate, the hindmost greatly so and much curved. Mammæ 8: 2 pairs pectoral, 2 inguinal. Vibrissæ numerous, fine, longer than the head.

Colour brown above, dull white below. Dorsal fur slaty for the basal two thirds, then glistening brown with black tips and a few long hairs of very fine texture interspersed. Whiskers black, and there is a tuft of fine blackish hair anterior to the ears (Blyth).

Dimensions of a female in spirit: head and body 5 inches, tail 8, ear from crown 0·25, hind foot 1·1; length of skull 1·4, breadth 0·8.

Distribution. Discovered by Major Berdmore at Schwe Gyeng, on the Sittoung River, Burma, in 1859. There is also in the Indian Museum, Calcutta, a specimen from Tavoy.

The terminal fourth of the tail is distinctly compressed laterally in the type specimen. Further specimens are required to show whether this is an individual character.

Genus **VANDELEURIA**, Gray (1842).

First and fifth toes on all feet partially opposable and furnished with a flat nail, not a claw. Claws on the remaining digits small. Hind foot long, plantar pads large; proximal metatarsal pad very elongate, quite as near to the heel as to the base of the middle toe. Tail very long, but without lengthened hair. Skull short, anterior palatine foramina moderate, anterior border of zygoma-root vertical, not emarginate above. Molars broad, transverse bands of enamel deeply folded. Lower molars as in *Mus*. Incisors narrow.

One species only is known.

270. **Vandeleuria oleracea.** *The long-tailed Tree-Mouse.*

Mus oleraceus, *Bennett, P. Z. S.* 1832, p. 121; *Elliot, Mad. Jour. L. S.* x, p. 214; *Blyth, J. A. S. B.* xxxii, p. 344; *id. Cat.* p. 120; *Jerdon, Mam.* p. 202.
Vandeleuria oleracea, *Gray, A. M. N. H.* x, p. 265 (1842); *W. Sclater, P. Z. S.* 1890, p. 532, pls. xliv, fig. 4, xlv, fig. 10; *Thomas, P. Z. S.* 1886, p. 65.
Mus (Vandeleuria) dumeticola *and* Mus povensis, *Hodgson, A. M. N. H.* xv, pp. 268, 269 (1845).
Mus badius, *Blyth, J. A. S. B.* xxviii, p. 295 (1859); *id. Cat.* p. 120; *id. Mam. Birds Burma*, p. 41.
Mus nilagiricus, *Jerdon, Mam.* p. 203.
Mus (Vandeleuria) oleraceus, *Anderson, An. Zool. Res.* pp. 309, 313; *Thomas, P. Z. S.* 1881, p. 556.

Marad ilei, Can.; *Meina Yelka*, Tel. of Yanadis.

Fur soft. Tail much longer than the head and body. Ears thinly clad with hair, large, rounded. Mammæ 8: 2 pairs pectoral, 2 inguinal.

Colour above light chestnut-red, varying from bright to dull, below white. Basal ¾ or more of dorsal hairs dark grey, termin-

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ations rufous, a few long black tips intermixed on the rump. Ventral hair white throughout. Tail uniformly dark. Feet white. One specimen from Fatigarh, obtained by the late Mr. A. Anderson, has a rufous cross on the breast.

Dimensions. Head and body 2·2 to 3 inches, tail 3·5 to 4·5, ear about 0·5, hind foot 0·7; length of skull 0·85. *Mus nilagiricus* is slightly larger, head and body 3·5, tail 5.

Distribution. Throughout India (except in the extreme north-west), Ceylon, Assam, and Burma, extending to Yunnan. This species ascends the Himalayas to a moderate elevation and is found, if *M. nilagiricus* is the same, on the top of the Nilgiris.

Habits. The present species inhabits trees and shrubs, and makes a nest, usually of grass or grass and leaves, in the branches. The nest is often found in palms or bamboos, occasionally on the roofs of houses. Three young on one occasion, and four in another were brought to me in a nest. The animal is very active.

Genus **CHIROPODOMYS**, Peters (1868).

Hallux and rudimentary pollex with flat nails instead of claws, the other digits with strong much-curved claws. Plantar pads broad, oval. Skull short and broad. Anterior palatine foramina short. Anterior border of zygoma-root outside the infraorbital foramen vertical throughout, not emarginate above. Incisors narrow, not grooved. Molars tubercular, the transverse bands of enamel on the worn surface much more deeply plicated than in *Mus*, lower molars with a broad outer cingulum. Crowns of all the molars, above and below, when worn, traversed by two deep longitudinal furrows, one furrow, on the lower molars, just inside the cingulum.

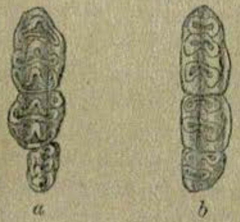

Fig. 130.—(*a*) Upper and (*b*) lower right molars of *C. gliroides*, × 6.

A single species.

271. **Chiropodomys gliroides.** *The penicillate-tailed Tree-Mouse.*

Mus gliroides, *Blyth, J. A. S. B.* xxiv, p. 721 (1855), xxxii, p. 345; *id. Cat.* p. 120.

Mus peguensis, *Blyth, J. A. S. B.* xxviii, p. 295 (1859), xxxii, p. 345, xxxiv, p. 193; *id. Cat.* p. 116; *id. Mam. Birds Burma*, p. 40.

Chiropodomys penicillatus, *Peters, MB. Akad. Berl.* 1868, p. 448, pl. i; *Doria, An. Mus. Civ. Genova*, ser. 2ª, iv, p. 631.

Chiropodomys gliroides, *Thomas, P. Z. S.* 1886, p. 78; *W. Sclater, P. Z. S.* 1890, p. 532.

Fur soft, dense and even. Tail much longer than the head and body, thinly clad with hairs, which are short near the root of the tail but become longer towards the tip. Feet short and broad. Ears large, nearly naked, rounded. Vibrissæ copious and long. Mammæ 4, all abdominal.

Colour brown, not dark nor rufous, above, white or buffy white below. Basal ¾ of dorsal hair dark leaden grey, terminal portion light brown (fawn-colour), passing into darker brown at the end. A few longer black tips are scattered on the back. Ventral fur white throughout. A dark mark generally on each hind foot, remainder of the feet white. Tail dark throughout.

Dimensions of a male in spirit: head and body 3 inches, tail 4·5, ear 0·6, hind foot 0·75. A skull measures 0·93 in length.

Distribution. Khási hills, Kakhyen hills, near Bhámo, Manipur, Schwe Gyeng, Malacca, Java, and Borneo.

Genus **MUS**, Linn. (1766).

Form slender. Muzzle pointed; tail long, scaly. Fur soft or spiny, the spines when present fine and mixed with hair. Pollex rudimentary, with a small flat nail, all other toes (except in *M. chiropus*) with compressed claws. Molars tubercular in the young; the tubercles of the upper molars in a triple longitudinal row, of the lower molars in a double row. The teeth when worn crossed by curved or folded transverse laminæ. Incisors smooth, not grooved nor sculptured. Vertebræ: C. 7, D. 13, L. 6, S. 4, C. 26–32.

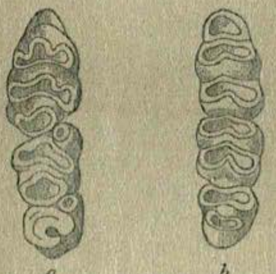

Fig. 131.—(*a*) Upper and (*b*) lower right molars of *M. rattus* (*M. rufescens*), × 4.

The genus is cosmopolitan and is largely represented in India. A great number of specific names have been given by various naturalists, and owing to imperfect descriptions, and to the difficulty of comparing the types, many of which were in England, Blyth in 'A Memoir of the Rats and Mice of India,' published in 1863 (J. A. S. B. xxxii, p. 327), could only collect together the descriptions of about 50 nominal forms and indicate their affinities. Jerdon followed Blyth, and it was not until Thomas in 1881 re-examined Gray's and Hodgson's types with the aid of a large collection of Indian specimens that any important reduction of the overgrown list of names could be effected. Some additional identifications of Blyth's and Anderson's species have since been made by Mr. Thomas, and a few more are now added by the examination of some of Blyth's types, for the loan of which I am indebted to the Trustees of the Indian Museum, Calcutta, and to Mr. W. L. Sclater, who has independently examined the series in the Calcutta Museum and has come to conclusions that agree with my own (P. Z. S. 1890, p. 522). In the present work, by the aid of several observers, an attempt is made to identify all Indian, Ceylonese, and Burmese species hitherto described.

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Synopsis of Indian, Ceylonese, and Burmese Species.

A. Six pads on planta; ears not covered with long hair; third upper molar much smaller than second.

a. Large, head and body 4 to 9 inches; proximal plantar pad elongate, double length of next pad. (RATS.)

a'. Lower surface of tail not white or not sharply divided from colour of upper surface.

a''. Hair on terminal portion of tail not white.

a^3. Outer border of infraorbital foramen deeply emarginate above.

a^4. Tail as long as head and body or longer.

α. Head and body 5 to 8 in., hind foot 1·2 to 1·45; mammæ 10–12 .... *M. rattus*, p. 406.

β. Head and body 4 in., hind foot 0·9; mammæ 8 .... *M. concolor*, p. 408.

b^4. Tail shorter than head and body, hind foot 1·5 to 1·7 .... *M. decumanus*, p. 408.

b^3. Outer border of infraorbital foramen slightly emarginate above; hind foot 1 inch .... *M. fulvescens*, p. 409.

b''. Hair on terminal portion of tail white all round.

a^3. Colour above grey.

a^4. A brownish tinge on back; hind foot 2 inches .... *M. bowersi*, p. 410.

b^4. Back pure grey; hind foot 1·4 .. *M. berdmorei*, p. 410.

b^3. Colour of upper parts brown; hind foot 1·3 .... *M. blanfordi*, p. 411.

b'. Lower surface of body and tail white, or nearly white, sharply separated from colour of upper parts.

a''. Hallux with a compressed claw.

a^3. Colour above rich rufous-brown .... *M. jerdoni*, p. 411.

b^3. Colour above greyish brown ...... *M. niviventer*, p. 412.

b''. Hallux opposable, with a flat nail .... *M. chiropus*, p. 413.

b. Small, head and body less than 4 in.; proximal plantar pad not double length of next, and generally rounded. (MICE.)

a'. Tail not shorter than head and body.

a''. Hind foot without claws not exceeding 0·7 in.; mammæ 10.

a^3. Lower parts fulvous or dusky ...... *M. musculus*, p. 413.

b^3. Lower parts white .... *M. bactrianus*, p. 414.

b''. Hind foot exceeding 0·7 in.

a^3. Fur dark brown above.

a^4. Malar bone concave externally .. *M. sublimis*, p. 415.

b^4. Malar convex externally .... *M. nitidulus*, p. 415.

b^3. Fur chestnut above; mammæ 6 .... *M. arianus*, p. 416.

CSL

b'. Tail shorter than head and body.
  a''. Fur spineless or mixed with flexible spines.
    a^3. Ear laid forward extending to eye . . *M. cervicolor*, p. 417.
    b^3. Ear not extending to eye . . . . *M. buduga*, p. 416.
  b''. Dorsal fur mainly or wholly of inflexible spines . . . . *M. platythrix*, p. 418.
B. Four or five plantar pads.
  a. Back dark brown; hind foot about 1 in. . . *M. mettada*, p. 419.
  b. Back sandy or fawn-colour; hind foot 0·7 in. *M. gleadowi*, p. 420.
C. Ears covered with long hair; hind foot 0·32 in. *M. erythrotis*, p. 420.
D. Second and third upper molars equal in size; hind foot 1 inch . . . . *M. humei*, p. 421.

272. **Mus rattus.** *The common Indian Rat.*

Mus rattus, *Linn. Syst. Nat.* i, p. 83 (1766); *Blyth, Cat.* p. 113; *W. Sclater, P. Z. S.* 1890, p. 523.
Mus alexandrinus, *Geoff. Desc. de l'Egypte, Hist. Nat.* ii, p. 733, *Atlas*, pl. v, fig. 1 (1812); *Scully, P. Z. S.* 1881, p. 204; *Thomas, P. Z. S.* 1881, p. 533.
Mus indicus, *Geoff., Desm. Mam.* p. 299 (1822), *nec Bechstein.*
Mus rufescens *and* asiaticus, *Gray, Charlesworth's Mag. N. H.* i, p. 585 (1837).
Mus rattus *and* flavescens (*nec Waterhouse*), *Elliot, Mad. Jour. L. S.* x, pp. 212, 214.
Mus brunneusculus, rattoides, nitidus, *and* horeites, *Hodgson, A. M. N. H.* (1) xv, pp. 267, 268 (1845).
Mus æquicaudalis, *Hodgson, A. M. N. H.* (2) iii, p. 203 (1849).
Mus nemoralis, *Blyth, J. A. S. B.* xx, p. 168; *id. Cat.* p. 114.
Mus kandianus, *Kelaart, Blyth, ibid.* p. 169.
Mus rattus, ceylonus, flavescens, nemoralis, *and* asiaticus, *Kelaart, Prod.* pp. 58, 61–63.
Mus robustulus, *Blyth, J. A. S. B.* xxviii, p. 294 (1859); *id. Cat.* p. 114; *id. Mam. Birds Burma*, p. 39.
Mus crassipes, *Blyth, J. A. S. B.* xxviii, p. 295.
Mus (Leggada) andamanensis, *Blyth, J. A. S. B.* xxix, p. 103 (1860); *id. Cat.* p. 114.
Mus rattus, andamanensis, nemoralis, rufescens, robustulus, nitidus, horeites, *and* æquicaudalis, *Blyth, J. A. S. B.* xxxii, pp. 338–344.
? Mus infralineatus, *Blyth, Cat.* p. 116 (no description).
Mus rattus, infralineatus, brunneus, rufescens, *and* nitidus, *Jerdon, Mam.* pp. 194, 197–201.
Mus palmarum, *Zelebor, Novarareise, Säugeth.* p. 26, pl. 3.
Mus sladeni *and* yunnanensis, *Anderson, An. Zool. Res.* pp. 305, 306.
Mus rattus rufescens, *Thomas, P. Z. S.* 1881, pp. 57, 71.

Chuha, *Músa*, H.; *Gachua-indur*, Beng.; *Kart yelli*, Tam.; *Ghasmiyo*, Cing.

Fur variable, occasionally mixed with fine spines, more often spineless. Tail generally longer than the head and body (more rarely about equal or a little shorter). Ears moderately large, extending to the eye or occasionally beyond it, when laid forward. Mammæ 10–12: 2 or 3 pairs pectoral, 3 inguinal. Foot-pads 5 on the fore foot, 6 on the hind, the hindmost of the latter (proximal metatarsal pad) considerably elongated.

Skull very slightly convex above, the nasals sometimes greatly produced. Lower portion of anterior border to zygomatic process of maxillary vertical, or slanting upwards and forwards, above rounded off to a deep emargination. Lower part of infraorbital foramen narrow, with a swelling in front on the maxillary bone. The fronto-parietal area pyriform, the low crest bordering the parietal region convex throughout. Incisors narrow; first upper molar much larger than the second, which is nearly double the size of the third.

Colour above in Indian specimens usually brown, more or less rufous or occasionally yellowish brown; more rarely blackish brown or black; below generally white, frequently sullied, sometimes brown or grey and occasionally with a white, fulvous, or grey median band. Basal three fourths of the dorsal hairs dark grey, the terminal fourth mostly light brown, mixed with longer black tips. When spines are present they are whitish near the base. Tail generally the same colour throughout, but sometimes paler beneath. Feet generally white. Incisors orange.

Dimensions. Head and body 5 to 8 inches, tail 5 to 9 or even more, hind foot without claws 1·2 to 1·5 ear 0·7 to 1. An average skull is 1·5 long by 0·75 broad.

Distribution. Almost world-wide, doubtless from being introduced. Probably indigenous in India and found throughout the country, also in Burma and Ceylon, from the sea-level to an elevation of at least 8000 feet.

Varieties. The typical *Mus rattus* of Europe, the black rat, is doubtless an introduced form. This variety is occasionally found in various parts of India, chiefly large ports, whither it has probably been brought by shipping. Besides this there are three Indian varieties requiring notice:—

1. *M. alexandrinus.*—Size generally large; colour above brown without much rufous tinge, below usually white. The tail is longer than the head and body. This form is found in Western India and extends thence to Northern Africa. Some specimens from Simla have the under surface of the tail quite white.
2. *Mus nitidus.*—This differs from the last in having finer fur often mixed with numerous spines, and in the tail differing but little in length from the head and body, being sometimes rather longer, sometimes a little shorter. Soles of feet often white. The common Eastern Himalayan form.
3. *Mus rufescens.*—A more slender and frequently smaller variety, with a long tail, generally spinous hair, and a rufous or yellowish-brown tint. The variety chiefly found in the Indian Peninsula, Ceylon, and Burma. More arboreal than the others.

Thomas, from whom I take most of these details, has shown that the length of the nasal bones varies in specimens from one locality from 46 to 69 per cent. of the length of the skull.

Mus infralineatus was founded on a small short-tailed specimen with a dark median line on the chest; *Mus andamanensis* on a very spiny variety (I have examined the type); and *Mus yunnanensis* on a form with unusually short hind feet. Like most widely diffused forms, this species is very variable.

Habits. This rat is found both on the ground, where it burrows, and in trees, where it builds nests amongst the branches. In the Laccadive Islands and other places it inhabits the crowns of cocoa-nut palms, and is said never to descend to the ground, but to live on the nuts and to do great damage by biting them off when unripe. It is common in houses everywhere, often living in the roofs. It feeds chiefly on fruit, grain, and vegetables, but is more or less omnivorous, though less carnivorous than *M. decumanus.* The young, which are produced several times in the year, are usually 7 to 9 in number and are born with the eyes closed.

273. **Mus concolor.** *The little Burmese Rat.*

Mus concolor, *Blyth, J. A. S. B.* xxviii, p. 295 (1859), xxxii, pp. 73, 344; *id. Cat.* p. 116; *id. Mam. Birds Burma,* p. 40; *Anderson, Fauna Mergui Archip.* i, p. 341; *W. Sclater, P. Z. S.* 1890, p. 526.

Fur harsh, chiefly composed on the back of flattened hairs or fine spines. Tail longer than the head and body. Ears reaching the eye when laid forward. Hindmost metatarsal pad elongate. Mammæ 8: 2 pairs pectoral, 2 inguinal. Skull similar to that of *M. rattus* in shape though much smaller; third upper molar about half the size of the second.

Colour above brown, slightly rufescent, lower parts paler brown; basal half of the dorsal hair grey, which passes gradually into brown, the tips being dark brown (probably black in fresh skins), fur of lower parts grey at the base. Tail brown throughout.

Dimensions of an adult male in spirit: head and body 4 inches, tail 4·35, ear from crown 0·45, hind foot 0·92; in another 4·5, 5·25, 0·55, and 1; in an adult female 4·1, 4·85, 0·55, and 0·85; extreme length of skull 1·1.

Distribution. Hitherto only recorded from Pegu and Tenasserim (Thayet Myo, Schwe Gyeng, the neighbourhood of Moulmein, Mergui and the Mergui Archipelago), but probably found also in Malacca.

A house-rat, inhabiting wooden buildings, and especially the thatch. This species is a small rat rather than a large mouse, and is structurally a miniature of *Mus rattus.*

274. **Mus decumanus.** *The brown Rat.*

Mus decumanus, *Pallas, Glires,* p. 91 (1779); *Elliot, Mad. Jour. L. S.* x, p. 212; *Kelaart, Prod.* p. 59; *Blyth, J. A. S. B.* xx, p. 167, xxxii, p. 335; *id. Cat.* p. 113; *id. Mam. Birds Burma,* p. 39; *Jerdon Mam.* p. 195; *Thomas, P. Z. S.* 1881, p. 532.
Mus decumanoides, *Hodgson, J. A. S. B.* x, p. 915 (no description).
Mus brunneus, *Hodgson, A. M. N. H.* xv, p. 266 (1845).

Chuha, Ghar-ka-chuha, H.; *Demsa-indur,* Beng.; *Kuté-elli,* Tam. *Manei-ilei,* Can.; *Gaval-Miyo,* Cing.; *Kymek,* Burmese.

Fur coarse and harsh. Tail shorter than the head and body. Ears short. Feet large. Mammæ 10–12.

Colour above brown, darkest on the back; lower parts white, or whity brown or light brown. Underfur dark-coloured throughout the body, on the back slaty grey; the terminal portion of the dorsal hairs in general light brown, but numerous longer black hairs are intermixed. Tail brown throughout.

Dimensions. An adult male measured: head and body 7 inches, tail 6·25, ear from orifice 0·77, hind foot 1·65; another, head and body 8, tail 6; a third 10·5 and 8·25, and probably even larger specimens might be found. Basal length of an average skull 1·65, extreme length 1·8, zygomatic breadth 0·9. A large Calcutta male skull is 2·15 inches long.

Distribution. This rat is certainly not indigenous in India, though now found in all large towns and villages, along the banks of navigable rivers and on high roads. It is unknown in Persia, and, it is said, in Afghanistan, but will probably be introduced when wheeled carriages take the place of pack animals in those countries. The source whence this rat has been distributed throughout the world is probably Chinese Mongolia.

Habits. As is well known, the brown rat is omnivorous and voracious; it is essentially parasitic, living about human habitations and cultivations, burrowing in houses, banks of fields, drains, &c. It is excessively prolific, breeding several times in the year, and producing from 4 to 12, or at times even more, young at a birth.

The brown rats in Calcutta grow to a large size and are often mistaken for bandicoots. They probably attain similar dimensions in some other Indian towns.

275. **Mus fulvescens.** *The chestnut Rat.*

Mus fulvescens, *Gray, Cat. Mam. &c. Nepal & Thibet B. M.* (1) p. 18 (1846); *Thomas, P. Z. S.* 1881, p. 537; *W. Sclater, P. Z. S.* 1890, p. 524.

Mus caudatior, *Hodgson, A. M. N. H.* (2) iii, p. 203 (1849) (no description); *Jerdon, Mam.* p. 201; ? *Blyth, Mam. Birds Burma,* p. 40.

? Mus cinnamomeus, *Blyth, J. A. S. B.* xxviii, p. 294 (1859), xxxii, p. 341, xxxiv, p. 193; *id. Cat.* p. 115.

Fur soft, generally without spines, but sometimes with flat spines intermixed. Tail longer than the head and body and having the hairs near the end a little longer and thicker than near the base. Teeth small. Anterior edge of zygomatic process of maxillary nearly vertical and but slightly emarginate above, much less so than in other species. Mammæ 8: 2 pairs pectoral and 2 inguinal.

Colour above bright rufous-brown, the back but little darker than the sides, sometimes mixed with grey; below white, and in one skin with a fulvous band down the middle of the breast. The dorsal and ventral colours sharply separated on the sides. Basal ¾ of dorsal hair leaden grey, terminal portion yellowish brown, the extremities darker, a few longer hairs black-tipped. Spines when present whitish except at the end. Tail dark, the same colour above as below.

Dimensions. Head and body 5·25 to 6, tail 7 to 8·4, ear from outer base 0·9, hind foot 1; total length of skull 1·3, breadth 0·6; weight 2½ oz.

Distribution. Nepal and Sikhim. Several specimens were obtained at Darjiling in houses by Mr. Hodgson.

Mus cinnamomeus, Blyth, was united to *Mus caudatior*, which is the same as *Mus fulvescens*, by Mr. Blyth himself. The colour, however, is much paler, the teeth considerably larger, and the anterior border of the maxillary zygomatic process much more emarginate. The type of *M. cinnamomeus* was from Schwe Gyeng, Barma, and measured, head and body about 6 inches, tail 7·75, hind foot 1·25. Further specimens are required to show whether this is the same as *M. fulvescens* or distinct.

276. **Mus bowersi.** *Anderson's Rat.*

Mus bowersi, *Anderson, An. Zool. Res.* p. 304, pl. xvii (1878); *Thomas, P. Z. S.* 1886, p. 62; *W. Sclater, P. Z. S.* 1890, p. 524, pl. xliv, fig. 2 (skull).

Fur thin, harsh and coarse, without spines, growing from the roots in small tufts of 3 or 4 hairs. Tail exceeding the head and body in length, and but thinly clad with very short hair. Ears large, almost naked. Mammæ 8: pectoral 2 pairs, inguinal 2.

Skull long, fronto-nasal portion elongate, and very straight above. Infraorbital foramen widely open below; the anterior border of the maxillary zygomatic process vertical at the lower base, then rounded, deeply emarginate above.

Colour above dark greyish brown (earthy brown), slightly grizzled, sides paler, lower parts white or pale yellow. No dark grey underfur; dorsal hairs whitish at the base, becoming gradually darker till they are blackish brown near the end, the extreme tip whitish. Longer piles are intermixed having long black points. Tail brown throughout, except the terminal portion, varying from $\frac{1}{6}$ to $\frac{1}{3}$, which is pale with white hair.

Dimensions. Head and body 9 inches, tail 10·25, ear 1·15, hind foot 2·15; basal length of skull 1·9, extreme length 2·1, zygomatic breadth 1·1.

Distribution. Hotha in Yunnan, Machi in Manipur, Karennee, and Tenasserim (*Fea*). Probably a tree-rat. A single specimen from the Andamans in the British Museum belongs either to a variety of *M. bowersi* or to a closely allied form.

277. **Mus berdmorei.** *The grey Rat.*

Mus berdmorei, *Blyth, J. A. S. B.* xx, p. 173, note (1851), ? xxiv, p. 712, xxxii, p. 343; *Thomas, P. Z. S.* 1886, p. 62; *W. Sclater, P. Z. S.* 1890, p. 525.

Fur coarse, moderately long, without spines. Tail about the same length as the head and body. Ears rounded. Nasal portion of skull long; the upper molars proportionally small, very distant from the incisors, which are directed forward. Mammæ 10.

Colour above dark ashy grey, grizzled or speckled, without any rufous or yellow admixture, below white. Dorsal hairs slaty grey from the base to near the tip, then there is a whitish subterminal ring and a blackish tip, the latter often wanting. Tail bicoloured; the upper surface of the basal half brown, the lower surface of the basal and the whole of the terminal half pale, with whitish or white hair. Feet white.

Dimensions taken from skins: head and body 7 inches, tail 6·9, hind foot 1·4, ear from crown 0·65; total length of skull about 1·5, zygomatic breadth 0·8. Some skins may indicate a larger size.

Distribution. The type, of which only the skull is now preserved, came from Mergui; specimens have since been obtained by Mr. Fea east of Moulmein, by Mr. Hume in Manipur, and I have a skin from the Khási hills. From these the above description is taken.

278. **Mus blanfordi.** *The white-tailed Rat.*

Mus blanfordi, *Thomas, A. M. N. H.* (5) vii, p. 24 (1881); *id. P. Z. S.* 1881, p. 541, pl. 1.

Fur long and soft, without spines. Tail longer than the head and body, hair on the terminal portion conspicuously longer and thicker. Feet broad, digits short. Mammæ 6 in the only female examined: 1 pair axillar, 2 inguinal. Fronto-parietal suture of skull forming almost a right angle in the middle. Anterior palatine foramina long.

Colour brown above, white below, the sides paler than the back. Basal three quarters or more of the dorsal fur leaden grey, terminal portion light brown or isabelline, the longer hairs on the back with long black tips. Feet white in old specimens, brownish in younger individuals. Tail brown at the base and for half to three-quarters the length, the terminal portion pale, clothed with longer white hairs.

Dimensions of adult male in spirit: head and body 6 inches, tail 8, hind foot 1·33; extreme length of skull 1·65, basal length 1·6, zygomatic breadth 0·8.

Distribution. Madras Presidency. This species has been found near Cuddapah by Col. Beddome, on the Nilgiri hills by Mr. Davison, and on the Shevaroys by Mr. Daly. It is probably a hill form.

279. **Mus jerdoni.** *The bicoloured Rat.*

Leggada jerdoni, *Blyth, J. A. S. B.* xxxii, p. 350 (1863); *Jerdon, Mam.* p. 209.
? Mus octomammis, *Hodgson, Cat. Mam. &c. Nepal & Thibet B. M.* 2nd ed. 1863, p. 10 (no description).
Mus jerdoni, *Blyth, Cat.* p. 121; *Thomas, P. Z. S.* 1881, p. 537.

Fur long, usually mixed with flattened spines. Tail considerably longer than the head and body. Mammæ 8: 2 pairs pectoral, 2 inguinal. Planta short. Earsl arge. Skull nearly flat above; nose elongate, anterior border of maxillary zygomatic process convex below, concave but not deeply emarginate above; bullæ small.

Colour above bright rufous-brown, darker on the back than on the sides, lower parts white, the colours sharply divided. Basal three-fourths of dorsal hair slaty grey, tips dull orange, the spines whitish with long black tips; ventral hair white throughout. Tail distinctly bicoloured throughout, dusky above, white below, the two colours contrasting strongly. Feet, as a rule, white, but the dark colour of the tarsus sometimes extends to the base of the digits.

Dimensions. Head and body of an adult female 5·5 inches, tail 7, hind foot 1·2, ear from orifice 0·75. Of another the head and body measured 5·4, tail 8·5. Basal length of a skull 1·3, extreme length 1·5.

Distribution. Eastern Himalayas at elevations of from 4000 to 7000 feet, Khási hills, Tenasserim (Fea), Java, and perhaps Formosa (*M. coxingi*); probably a hill-species everywhere. The Western Himalayan specimens mentioned by Jerdon are referred by Thomas, probably with justice, to another species.

280. **Mus niveiventer.** *The white-bellied Rat.*

Mus (Rattus) niviventer, *Hodgson, J. A. S. B.* v, p. 234 (1836); *Blyth, J. A. S. B.* xxviii, p. 295, xxxii, p. 342.
Mus niviventer, *Jerdon, Mam.* p. 200; *Thomas, P. Z. S.* 1881, p. 540.

Fur of moderate length, sometimes thickly mixed with flattened spines, sometimes without spines. Tail a little longer than the head and body, with the hair towards the tip rather longer and thicker than elsewhere. Skull very similar to that of *M. jerdoni*.

Colour dull brown above, with more or less of a greyish tinge, sides a little paler than the back, lower parts white, the colours sharply divided on the sides. Basal two-thirds or more of the dorsal fur leaden grey, spines whitish, terminal portion of hairs isabelline (whity brown), the spines with long black tips. Feet whitish. Tail distinctly bicoloured, the upper surface dark brown, lower whitish or white.

Dimensions. Head and body 5·25 inches, tail 6, hind foot 0·92; extreme length of skull about 1·3. Blyth gives larger dimensions for specimens from Mussooree.

Distribution. Himalayas from Simla to Katmandu in Nepal. Jerdon adds Darjiling, but he possibly mistook spineless specimens of *M. jerdoni* for the present form.

Besides being much greyer in colour, the present species is distinguished from *M. jerdoni* by having a comparatively shorter tail.

281. **Mus chiropus.** *Fea's Rat.*

Mus chiropus, *Thomas, Ann. Mus. Civ. Gen.* 2 *a*, x (1891).

Similar in size and proportions to *M. jerdoni*, but with the hallux opposable and, like the pollex, furnished with a flat nail in place of a claw. Fur long, not spinous, but with a few flattened bristles intermixed. In the skull the anterior border of the maxillary zygomatic process slopes slightly backward from the lower end, and is nearly straight throughout, being scarcely emarginate above.

Colour above rufous-brown, sides and outer surfaces of limbs bright rufous, lower parts white, the colours sharply defined. Tail dark above, pale below.

Dimensions. Head and body of an adult male in spirit 5 inches, tail 8, hind foot 1·2, ear 0·6; basal length of skull 1·25, extreme length 1·5.

Distribution. Karennee. A single specimen was obtained by Mr. L. Fea at an elevation of about 4500 feet above the sea.

282. **Mus musculus.** *The common House-Mouse.*

Mus musculus, *Linn. Syst. Nat.* xii, p. 83; *Elliot, Mad. Jour. L. S.* x, p. 214; *Blyth, J. A. S. B.* xxi, p. 351, xxviii, p. 296.
Musculus nipalensis, *Hodgson, J. A. S. B.* x, p. 915 (no description).
Mus manei, *Gray, List Mam. B. M.* p. 111 (1843) (no description); *Kelaart, Prod.* p. 64; *Blyth, J. A. S. B.* xxix, p. 103.
Mus urbanus, *Hodgson, A. M. N. H.* xv, p. 269 (1845); *Blyth, J. A. S. B.* xxxii, p. 345; *id. Cat.* p. 118; *Thomas, P. Z. S.* 1881, p. 544; *W. Sclater, P. Z. S.* 1890, p. 527.
Mus dubius, *Hodgson, ibid.* p. 268.
Mus homourus, *Hodgson, ibid.* p. 268; *Blyth, J. A. S. B.* xxxii, p. 346; *id. Cat.* p. 118.
Mus darjeelingensis, *Hodgson, A. M. N. H.*(2) iii, p. 203 (1849) (no description); *Horsfield, Cat.* p. 143.
? Mus tytleri, *Blyth, J. A. S. B.* xxviii, p. 296, xxxii, p. 346.
Mus rama, *Cantor, Blyth, J. A. S. B.* xxxiv, pt. 2, p. 194.
Mus urbanus, homourus, darjeelingensis, *and* tytleri, *Jerdon, Mam.* pp. 203–205.
Mus kakhyenensis *and* viculorum, *Anderson, An. Zool. Res.* pp. 307, 308.

Músi, Chuhi, Mesuri, H.; *Chutu,* Kol.; *Lengtia indur,* Beng.; *Manei buduga,* Can.; *Kusettamiyo,* Cing.; *Shintad gandu,* Wadári, Ahmednagar.

Fur short, without spines. Tail almost naked, generally longer than the head and body, but sometimes the same or even a little less. Ears rounded, extending to the eye when laid forward. Mammæ 10: 3 pairs pectoral, 2 inguinal. Skull convex above; third molar in both jaws very small, about one third the size of the second.

Colour above varying from dark to light brown, below paler and greyer, but never white. Underfur dark ashy grey throughout the body; tips on the back light brown, generally but not always mixed with longer black terminations. Tail the same dark colour throughout.

Dimensions. Head and body 2·5 to 3 inches, tail 2·5 to 3·5, ear 0·4 to 0·5 from orifice, hind foot 0·6 to 0·7. The above are from fresh specimens. A skull measures 0·92 in extreme length and 0·43 in breadth.

Distribution. Found in houses everywhere in India except in the Punjab, Sind, Rajputána, and part of the North-West Provinces; also found throughout Ceylon and Burma. It is difficult to say whether this species is indigenous or introduced. *Mus musculus* is of almost world-wide distribution.

Varieties and *Synonymy.* I have followed Mr. Thomas in re-uniting the Indian with the European house-mouse, for after going over the collections in the British Museum, I can find no constant distinctions between them. The differences mentioned by Blyth and quoted by Jerdon are certainly not constant. The Himalayan form *Mus homourus* has in general a shorter tail than the common mouse of the plains (*M. urbanus*), and the fur is longer and softer, in accordance with the colder climate of the Himalayas. It is, I think, probable that *M. tytleri* should be assigned to *M. bactrianus*, but as no type is known this question cannot be determined.

Habits. The common mouse is chiefly found in houses, but sometimes in gardens and fields near villages and towns. It is excessively active, climbing vertical walls of considerable height, and springing farther than most allied species. It is omnivorous, living mainly, however, on grain and the remains of men's food. It breeds from 3 to 5 times in the year and produces at each birth from 4 to 8 young, which are born blind, but attain full growth and are capable of propagation in less than a year.

283. **Mus bactrianus.** *The Persian House-Mouse.*

Mus bactrianus, *Blyth, J. A. S. B.* xv, p. 140 (1846), xxxii, p. 347, xxxiv, p. 193; *Jerdon, Mam.* p. 205; *Blanford, Eastern Persia*, ii, p. 56, pl. v, fig. 2; *Thomas, P. Z. S.* 1881, p. 546.
Mus gerbillinus *and* theobaldi, *Blyth, J. A. S. B.* xxii, pp. 410, 583.
Mus gerbillinus, *Blyth, Cat.* p. 119.

Structure similar to that of *Mus musculus*, except that the tail is generally rather shorter than the head and body, rarely longer in fresh specimens.

Colour above light sandy brown or fawn-colour, below white, the two colours not sharply separated. Basal three-fourths of dorsal hairs slaty grey, tips light brown; a varying number of black tips intermixed. On the lower parts the fur is sometimes pale grey at the base. Tail dark above, pale beneath.

Dimensions. A good-sized male (fresh) measured: head and body 3·5 inches, tail 3·3, ear from orifice 0·55, hind foot 0·7. Extreme length of a skull 0·88. Some specimens are considerably smaller.

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Distribution. Throughout South-western Asia, extending into North-western India and to Egypt. This is the common house-mouse in Sind, the Punjab, and Western Rajputána, and is also found in Kashmir and Ladák.

284. **Mus sublimis.** *The upland Mouse.*

Mus sublimis, *Blanford, Yark. Miss., Mam.* p. 51; *Scully, A. M. N. H.* (5) viii, p. 99 (1881); *W. Sclater, P. Z. S.* 1890, p. 528.

Fur soft and rather long. Tail exceeding the head and body in length. Ears moderately large. Skull with frontal and nasal portion nearly straight and the zygomatic arches distinctly concave on their outer surfaces.

Colour brown above, whitish below, all the hair except the tips dark slaty grey throughout the body, tips of the dorsal hairs light brown, longer hairs with dark brown or black tips being intermixed in abundance.

Dimensions of a female in spirit: head and body 2·6 inches, tail 3·05, ear from orifice 0·5, hind foot 0·83; length of skull 0·92.

Distribution. The type was obtained by Dr. Stoliczka at Tankse west of Pangong Lake, Ladák, at an elevation of 13,000 feet Another specimen is recorded by Scully from Astor, at 11,000.

This form may turn out to be a variety of *M. musculus.*

285. **Mus nitidulus.** *Berdmore's Mouse.*

Mus nitidulus, *Blyth, J. A. S. B.* xxviii, p. 294 (1859), xxxii, p. 347; *id. Cat.* p. 119; *id. Mam. Birds Burma*, p. 40; *Thomas, P. Z. S.* 1881, p. 550; *W. Sclater, P. Z. S.* 1890, p. 529.

Fur long, sometimes spiny, sometimes not. Tail equal to the head and body, or longer, uniformly clad with very short hairs. Ears large, rounded. Hind foot longer than in *M. musculus*, hinder metatarsal pad slightly long. Skull elongate, fronto-parietal suture nearly straight instead of deeply concave; anterior border of zygomatic process of maxillary sloping backwards and upwards from the base.

Colour above brown with but little rufous tinge, below white somewhat sullied. Underfur grey throughout the body; tips of the fine hair on the back pale brown, of the spines dark brown, probably black in some specimens. Tail dark above, pale below.

Dimensions of an adult female in spirit: head and body 3·1 inches, tail 3·52, ear 0·48, hind foot 0·77; extreme length of skull 0·93.

Distribution. The type, now lost, was procured at Shwe Gyeng in Burma by Captain Berdmore. Mr. Thomas has identified with this species specimens from Sikhim, Bhámo, and Karennee. One from the Khási hills is referred to *nitidulus* by Mr. W. Sclater with some doubt.

286. **Mus arianus.** *The Persian long-tailed Field-Mouse.*

Mus erythronotus, *Blanford, A. M. N. H.* (4) xvi, p. 311 (1875); *id. Eastern Persia*, ii, p. 54, pl. v, fig. 3; *id. Yark. Miss., Mam.* p. 54; *id. J. A. S. B.* xlviii, pt. 2, p. 97; *nec Temminck.*

Mus arianus, *Blanford, A. M. N. H.* (5) vii, p. 162 (1881); *Scully, P. Z. S.* 1881, p. 205; *Thomas, P. Z. S.* 1881, p. 548; *Buchner, Wiss. Res. Przewalski Reis., Säugth.* p. 90; *W. Sclater, P. Z. S.* 1890, p. 528.

Fur soft, spineless. Tail about equal to the head and body, sometimes a little shorter or longer, thinly clad with hair, which becomes longer towards the extremity. Ear when laid forward reaching the eye, thinly clad. Proximal metatarsal pad small, not elongate. Mammæ 6: 2 pairs inguinal, 1 pectoral. Skull elongate. Third upper molar about half as large as the second. Anterior palatine foramina not extending back as far as the molars.

Colour rufous-brown above, white or pale yellowish grey below, the two colours sharply divided, back darker than sides. Underfur dark grey throughout the body, terminal fourth of the hairs on the back chestnut, mixed with longer black tips. Upper lips white. Tail-hair black or mixed black and white above to the end, white on the sides and below.

Dimensions of a male: head and body 4 (in spirit 3·5), tail 4·2, ear 0·7, hind foot 0·85; length of skull 1·1.

Distribution. This species has a wide range in Central Asia, being found in Persia, Eastern Turkestan, and the Central Tianshan. It has only occurred within Indian limits in Gilgit, where it is common from 5000 to 10,000 feet elevation.

Habits. Found in cultivated fields and on grassy downs near forests. This mouse enters houses in winter. It has doubtless the same habits as its near European ally *Mus sylvaticus.*

This mouse represents in Central Asia the European *M. sylvaticus* and the Chinese *M. chevrieri.* All the three are closely allied.

287. **Mus buduga.** *The common Indian Field-Mouse.*

Leggada booduga, *Gray, Charlesworth's Mag. Nat. Hist.* i, p. 586 (1837).

Mus lepidus, *Elliot, Mad. Jour. L. S.* x, p. 216 (1839); *Blyth, Cat.* p. 121.

Mus terricolor, *Blyth, J. A. S. B.* xx, p. 172 (1851), xxxii, p. 349; *id. Cat.* p. 119; *Jerdon, Mam.* p. 206.

Mus fulvidiventris *and* albidiventris, *Blyth, J. A. S. B.* xxi, p. 351, xxxii, p. 349.

Mus cervicolor, *Kelaart, Prod.* p. 64, *nec Hodgson.*

Leggada lepida, *Blyth, J. A. S. B.* xxxii, p. 350; *Jerdon, Mam.* p. 209.

Mus beavanii, *Peters, P. Z. S.* 1866, p. 559; *Blyth, Mam. Birds Burma*, p. 40.

Mus (Leggada) buduga, *Thomas, P. Z. S.* 1881, p. 553; *W. Sclater, P. Z. S.* 1890, p. 531.

Shintad-phurka, Shintad-bhurka, Wadári; *Chitta Yelka*, Tel. of Yanadis.

Fur short and close, often but not always spiny. Tail slender,

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nearly naked, considerably shorter than the head and body. Ears moderate, rounded, thinly clad. Feet small; planta narrow, the proximal pair of plantar pads small, close together and near the next pair, so that all the pads are more distally situated than in *M. musculus*. Mammæ 10: 3 pairs pectoral, 2 inguinal.

Skull more depressed than in *M. musculus* and occipital region flatter. Lower portion of infraorbital foramen more open, and anterior border of maxillary zygoma-root usually convex to the base. First upper molar sometimes with an additional anterior cusp and often with an elongate anterior spur with or without a cusp. In some cases both cusp and spur are wanting.

Colour above varying from pale sandy to dark greyish brown, below white. Basal half or more of dorsal fur dark grey, tips brown, a few longer hairs with black terminations intermixed on the rump. Underfur on lower parts sometimes grey. Tail paler below.

Dimensions. Head and body 2·4 to about 3 inches, tail 2·1 to 2·7. A male in spirit measured: head and body 2·8, tail 2·45, ear 0·4, hind foot 0·65. Extreme length of a skull 0·75.

Distribution. The Peninsula of India and Ceylon generally. Not recorded from the Indus valley (except from Karáchi) or the Himalayas. I have specimens from Ajmere and from Fatehgarh, N.W.P. Blyth's Burmese locality for *Mus beavani* is, I think, probably due to some mistake, but a specimen was obtained at Bhámo by Mr. Fea.

Habits. Common in fields, living in small burrows, often under roots or stones; found also in gardens, in woods, and sometimes in houses. Jerdon states that a little heap of stones is generally found near the hole of this mouse. Usually only a pair of *M. buduga* are found in one burrow. This species was found in houses by Kelaart and by Jerdon, for the description, under *M. darjilingensis* (Mam. p. 205), of a house-mouse found by the latter at Jalna and Nagpur clearly refers to the present form.

Gray's name *booduga* was perhaps derived by some complicated process from *bhurka*.

288. **Mus cervicolor.** *The fawn-coloured Mouse.*

Mus cervicolor, *Hodgson, A. M. N. H.* xv, p. 268 (1845); *Blyth, J. A. S. B.* xxxii, p. 349; *id. Cat.* p. 119; *Jerdon, Mam.* p. 206; *Thomas, P. Z. S.* 1881, p. 547, 1886, p. 65.

Mus strophiatus, *Hodgson, ibid.*; *Blyth, J. A. S. B.* xxxii, p. 349.

Mus cunicularis, *Blyth, J. A. S. B.* xxiv (1855), p. 721, xxxii, p. 348; *id. Cat.* p. 119.

Fur soft, spineless. Ears large, extending to the eye when laid forward. This mouse is similar in other details of structure to *Mus buduga*.

Colour dark fawn or moderately pale rufescent brown to darker brown above, white below; underfur dark grey throughout, longer black terminations mixed with the light brown tips of the dorsal fur. Tail the same colour throughout.

Dimensions. Head and body 2·9 inches, tail 2·65, ear 0·5, hind foot 0·65; skull 0·8.

Distribution. Nepal, Eastern Bengal, Assam, and the Khási hills. Specimens from the neighbourhood of Calcutta, originally described as *M. albidiventris* and subsequently referred to this species by Blyth, are shown by Mr. W. Sclater to belong to *M. buduga*. It is doubtful whether *M. buduga* and *M. cervicolor* should be kept distinct.

289. **Mus platythrix.** *The brown spiny Mouse.*

Mus platythrix, *Bennett, P. Z. S.* 1832, p. 121; *Elliot, Mad. Journ. L. S.* x, p. 215; *Blyth, Cat.* p. 121.
Leggada platythrix, *Gray, Charlesworth's Mag. N. H.* i, p. 586; *Blyth, J. A. S. B.* xxxii, p. 350; *Jerdon, Mam.* p. 207.
Mus spinulosus, *Blyth, J. A. S. B.* xxiii, p. 734 (1854), xxix, p. 111; *id. Cat.* p. 121.
Leggada spinulosa, *Blyth, J. A. S. B.* xxxii, p. 349; *Jerdon, Mam.* p. 208.
Mus (Leggada) platythrix, *Thomas, P. Z. S.* 1881, p. 553; *W. Sclater, P. Z. S.* 1890, p. 531.

Legyáde, Legadgandu, or *Ŕále-lagangandu*, Wadári; *Gíjeli-gandu*, Tel. of Yanadis; *Kal ilei*, Can.

Fur above and below composed almost entirely of flattened spines, those on the back stiff and coarser than those on the lower parts. Tail shorter than the head and body, rather thick at the base, clad with short hair, rather more thickly than in *Mus* generally. Ears short, rounded. Mammæ 10: 3 pairs pectoral, 2 inguinal. Hind foot small, all the 6 pads near together, the metatarsal pair small, round, and distant from the heel. Anterior palatine foramina long, extending back to the middle of the first molar; anterior edge of maxillary zygoma-root straight. First upper molar normally very long, with an anterior spur bearing a distinct cusp, but in some skulls the spur is wanting and the cusp rudimentary. Third upper molar about one third the size of the second.

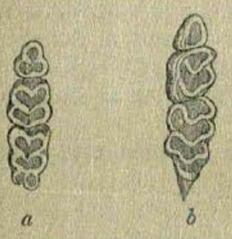

Fig. 132.—(*a*) Upper and (*b*) lower right molars of *M. platythrix*, ×5.

Colour above dark brown, occasionally paler, below white, the separation of the two colours well defined. Basal half of dorsal fur grey, terminal half brown, a few longer black points being mixed on the rump. Tail-hairs dark above, white below.

Dimensions. Head and body of an adult male (in spirit) 3·3 inches, tail 3, ear 0·4 (from orifice 0·5), hind foot 0·7. Skull 1 inch long.

Distribution. The peninsula of India and Ceylon. This form has been obtained in the Punjab, in Sind, and in Malabar, but not in Bengal.

Habits. According to Sir W. Elliot, "the Leggyade lives entirely in the red gravelly soil in a burrow of moderate depth, generally on the side of a bank. When the animal is inside the entrance is closed with small pebbles, a quantity of which are collected outside, by which its retreat may always be known. The burrow leads to a chamber in which is collected a bed of small pebbles on which it sits. Its food appears to be vegetable. In its habits it is monogamous and nocturnal."

The genus *Leggada* of Gray, classed apart from *Mus* by Jerdon and some others, was founded on *Mus buduga*, but the present species, which was included, is more characteristic. The only important distinction is the form of the anterior upper molar, and that is variable, there being, in *Mus buduga*, a complete passage to the ordinary murine form of the tooth.

290. **Mus mettada.** *The metad Rat, or soft-furred Field-Rat.*

Golunda meltada, *Gray, Charlesworth's Mag. N. H.* i, p. 586 (1837)
Blyth, J. A. S. B. xxxii, p. 352; *Jerdon, Mam.* p. 213.
Mus mettade *and* M. lanuginosus, *Elliot, Mad. Jour. L. S.* x, pp. 208, 212.
Mus mettada, *Blanford, J. A. S. B.* xlvi, pt. 2, p. 290, pl. i; *Thomas, P. Z. S.* 1881, p. 550; *W. Sclater, P. Z. S.* 1890, p. 530.

Mettád, Mettangandu, Wadári.

Fur dense, fine and soft, without spines. Tail about the same length as the head and body or rather less, not pencilled. Ears rounded, moderately large, very thinly clad with short hair. Planta with 4 or 5 pads only. Mammæ 8: 2 pairs pectoral, 2 inguinal. Skull convex above, anterior palatine foramina long.

Colour above dark greyish brown (earthy brown), paler on the sides, and white below. Basal three fourths or more of the dorsal fur leaden black; tips light brown, mixed on the back with numerous rather longer black terminations. Basal portion of fur on lower parts very dark grey. Feet whitish. Hairs on tail dark brown above, white below.

Dimensions of a male in spirit: head and body 5 inches, tail 4·2, ear from orifice 0·75, hind foot 1·05; extreme length of skull 1·38, basal length 1·2, zygomatic breadth 0·63.

Distribution. Found in several parts of the Peninsula of India—Etawah and Banda, Ahmednagar, Dharwar, Cuddapah, Anaimalai hills, and various other parts of the Madras Presidency. Mr. Murray has obtained this species in Sind. The Ceylon specimens mentioned by Blyth (J. A. S. B. xx, p. 167) were, however, wrongly identified.

Habits. These have been described by Sir W. Elliot, who says:—"The Mettade lives entirely in cultivated fields, in pairs or small societies of five or six, making a very slight and rude hole in the root of a bush, or merely harbouring among the heaps of stones thrown together in fields, in the deserted burrow of the kok, or contenting itself with the deep cracks and fissures formed in the black soil during the hot months. Great numbers perish annually, when these collapse and fill up at the commencement of the rains.

"Their flesh is eaten by the tank-diggers. The female produces from 6 to 8 at a birth."

Sir W. Elliot also states that when the rainfall was deficient at the commencement of the season, the metad rats bred in such numbers as to become a perfect plague and to destroy the crops.

291. **Mus gleadowi.** *The sand-coloured Rat.*

Mus gleadowi, *Murray, P. Z. S.* 1885, p. 809, pl. li; *W. Sclater, P. Z. S.* 1890, p. 531.

Fur soft, without spines. Tail about the same length as the head and body, or shorter, not pencilled. Eyes large. Ears large, reaching the front of the eye when laid forward, thinly clad. Planta narrow, and bearing only four pads. Mammæ 6: 1 pair pectoral, 2 inguinal. Skull convex above, similar to that of *Mus mettada*.

Colour above sandy (light greyish brown) or sometimes fawn, below and the feet white. Basal three fourths of dorsal fur dark leaden grey, terminal portion pale whitish brown, a few of the hairs tipped dark brown; no black hairs. Underfur of lower parts white. The short hair on the tail is light brown above, white below.

Dimensions in spirit: head and body 3·5 inches, tail 3, ear 0·63, hind foot 0·7; extreme length of skull 1.

Distribution. The types were from Karáchi, Sind. A fawn-coloured specimen in the British Museum was received from Kattiwar. There are other specimens in the Indian Museum from Cutch and from Goona, south of Gwalior.

292. **Mus erythrotis.** *The hairy-eared Mouse.*

Mus erythrotis, *Blyth, J. A. S. B.* xxiv, p. 721 (1855), xxxii, p. 448; *id. Cat.* p. 120; *W. Sclater, P. Z. S.* 1890, p. 529, pl. xliv, fig. 5 (skull).

Fur long, dense, soft. Tail longer than head and body, clad with hairs rather longer than usual, but no longer at the end of the tail than elsewhere. Ears small, round, hairy, almost concealed by the fur. Mammæ 8. Proximal plantar pad oval. In the skull the anterior border of the maxillary zygomatic process is straight and vertical, the zygoma itself slightly concave.

Colour "rich dark brown, grizzled and brightly tinged with rufous or rufo-ferruginous towards the tail and upon the ears conspicuously; lower parts albescent, tinged with fawn; feet with brown hairs upon their upper surface" (Blyth). Basal portion of hair above and below dark slate-colour.

Dimensions of an adult female in spirit: head and body 2·85 inches, tail 3·25, hind foot without claws 0·68, ear-conch 0·32; length of skull 0·8, greatest breadth 0·42.

Distribution. Cherra Poonjee in the Khási hills, and Manipur. *Mus pygmæus* of A. Milne-Edwards from Moupin is perhaps the same.

293. **Mus humei.** *Hume's Rat.*

Mus humei, *Thomas, A. M. N. H.* (5) xvii, p. 84 (1886); *id. P. Z. S.* 1886, p. 63, pl. v.

Fur soft, without spines. Tail shorter than the head and body, more hairy than it usually is in *Mus*, but not pencilled at the end. Ears moderately large, rounded, thinly clad. Thumb the merest rudiment; 5th front toe very short, barely reaching the division between the 2nd and 3rd toes; 5th hind toe just reaching the base of the 4th. Mammæ 8: 2 pairs pectoral, 2 inguinal. Skull convex above, the nasals short, anterior border of maxillary zygomatic process concave below and with a salient angle above. Molars broad, the third as long as the second.

Colour above speckled brown, a mixture of black and isabelline, the anterior portions of the body greyish, the rump and between the thighs rich rufous; underparts pale rufescent or yellowish. Underfur both above and below leaden grey, blackish on the back, where most of the hairs have isabelline tips, but longer hairs are intermixed that are black throughout. Feet brown. Tail particoloured, the short hair black above, white below, but the scaly skin is brown.

Dimensions taken from skins: head and body 5 inches, tail 4·25, hind foot 1, ear 0·5; length of skull about 1·1, zygomatic breadth 0·6.

Distribution. The only locality yet known is Moirang, Manipur, where Mr. Hume obtained six specimens.

This species resembles *Golunda ellioti* in coloration and the form of the skull.

Genus **NESOCIA**, Gray (1842).

Syn. *Nesokia*, Gray; *Spalacomys*, Peters (1860).

Form robust; head short, rounded, muzzle short and broad; tail long, scaly, ringed, almost naked; ears rounded; feet broad, planta with six pads, the proximal pad elongate; all the toes except the rudimentary pollex with strong, nearly straight claws.

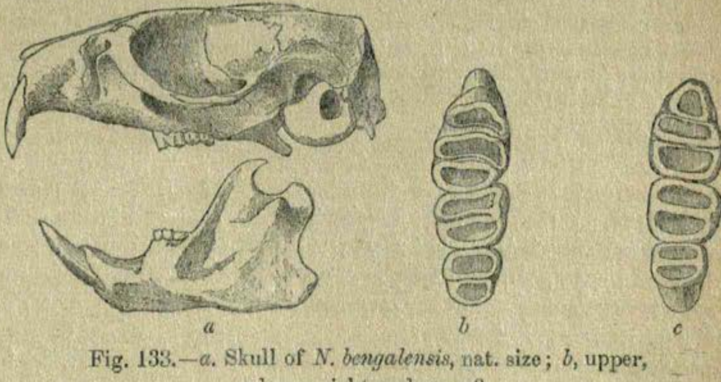

Fig. 133.—*a*. Skull of *N. bengalensis*, nat. size; *b*, upper, *c*, lower right molars, ×3.

MINISTRY OF CULTURE · GOVERNMENT OF INDIA
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Incisors broader than in *Mus*, the anterior surface of the upper pair minutely sculptured with irregular longitudinal wrinkles. Molars composed of transverse laminæ, straight or slightly curved, 3 in the first molar, 2 in the second and third in both jaws. Pterygoids very thin and high, pterygoid fossa deep. Infraorbital foramen typical; lower portion very narrow, the outer border slanting forward from the base (less in *N. hardwickei*), then broadly rounded and deeply sinuate. Anterior palatine foramina narrow. Fronto-parietal area narrow, bordered by strong lateral crests.

It is doubtful whether this should rank as more than a subgenus of *Mus*. Four species are found within Indian limits; the only other known forms are from Central Asia.

Synopsis of Indian, Ceylonese, and Burmese Species.

a. Tail less than ⅔ head and body; mammæ 8 .. *N. hardwickei*, p. 422.
b. Tail more than ⅔ head and body.
  a'. Smaller; hind foot 1″·25–1″·45; mammæ 14–18 .... *N. bengalensis*, p. 423.
  b'. Larger; hind foot 1″·9; mammæ 12 ...... *N. nemorivaga*, p. 426.
  c'. Still larger; hind foot 2″·5; mammæ 12 .. *N. bandicota*, p. 425.

294. **Nesocia hardwickei.** *The short-tailed Mole-Rat.*

? Arvicola indica, *Gray & Hardw. Ill. Ind. Zool.* i, pl. xi (1832) (no description, very bad figure); *nec* Mus indicus, *Bechstein, nec idem, Geoffroy.*
Mus hardwickii, *Gray, Charlesworth's Mag. N. H.* i, p. 585 (1837); *Blyth, J. A. S. B.* xxxiv, pt. 2, p. 193.
Nesokia hardwickii, *Gray, A. M. N. H.* x, p. 265 (1842); *Jerdon, Mam.* p. 190; *W. Sclater, P. Z. S.* 1890, p. 522.
Mus pyctorhis, *Hodgson, A. M. N. H.* xv, p. 267 (1845).
Mus huttoni, *Blyth, J. A. S. B.* xv, p. 139 (1846).
Nesokia griffithii, *Horsfield, Cat.* p. 145 (1851).
Spalacomys indica, *Peters, Abhandl. Akad. Berl.* 1860, p. 143, pl. ii, fig. 1.
Nesokia indica, *Blyth, J. A. S. B.* xxxii, p. 328, partim.
Mus (Nesokia) indicus, *Blyth, Cat.* p. 112, partim.
Nesokia huttoni, *Blanford, Eastern Persia*, ii, p. 59, pl. vi, fig. 1.
Mus (Nesokia) hardwickii, *Anderson, J. A. S. B.* xlvii, pt. 2, p. 221; *Thomas, P. Z. S.* 1881, p. 524.
Mus (Nesokia) huttoni, *Anderson, ibid.* p. 223.

Fur varying in texture. Longer hairs on back not conspicuous. Tail half to two thirds the length of the head and body. Ears small. Feet very thinly clad above. Mammæ 8: 2 pairs inguinal, 2 pectoral. Skull short, muzzle especially so. Anterior palatine foramina very small, shorter than the crowns of the upper molars together. Incisors broad.

Colour above yellowish to rufous-brown, not dark, isabelline or hoary below. The basal two-thirds or more of all hairs, dorsal and ventral, dark leaden grey, terminal portion on back pale yellowish brown or rufescent, a few longer black-tipped hairs scattered over the lower back and rump.

Dimensions. Head and body 5·5 inches to 8·5, tail 3·5 to 5, ear outside 0·5, hind foot 1·25 to 1·5. The above dimensions in an average-sized male were 6·6, 4·4, 0·5, and 1·3. Basal length of skull 1·65, zygomatic breadth 1·15.

Distribution. North-western India (North-West Provinces, Rájputána, Sind, and the Punjab), Afghanistan and Baluchistan, up to 4000 or 5000 feet elevation. A specimen has been obtained as far east as Purneah, Bengal.

Varieties. N. huttoni is distinguished by softer fur, often bright rufous or yellowish brown in colour. The hind feet are longer, 1·4 to 1·5 inches without claws. This form is found at higher elevations in Baluchistan and Afghanistan.

Typical *N. hardwickei* has harsher fur and is duller and browner in colour, the hind foot measuring 1·2 to 1·3. This is found in N.W. India. The two pass into each other.

Habits. The short-tailed mole-rat is found both in cultivated and in waste ground. I have often seen their holes about irrigated wheat-fields, but usually drier situations are preferred. The burrows run irregularly, ramifying frequently, at a depth of 6 inches to 2 feet below the surface. In one series of burrows that I explored I found a nest lined with grass at a depth of 1½ to 2 feet, and I captured 4 *Nesokiæ*, 2 males and 2 females. The entrances to the burrows are covered by small heaps of earth, like mole-hills, thrown out by the rats. This animal feeds on grass, roots, and grain.

N. scullyi from near Yárkand, and *N. brachyura* from Lob-nor, are Central Asiatic forms allied to *N. hardwickei*.

295. **Nesocia bengalensis.** *The Indian Mole-Rat.*

Arvicola bengalensis, *Gray & Hardw. Ill. Ind. Zool.* ii, pl. 21 (1833–34).
Mus kok, *Gray, Charlesworth's Mag. N. H.* i, p. 585 (1837).
Mus (Neotoma) providens, *Elliot, Mad. Jour. L. S.* x, p. 209 (1839).
Nesokia hardwickii, *Kelaart, Prod.* p. 65, *nec Gray*.
Nesokia kok, *Kelaart, ibid.* p. 66.
Mus daccaensis, *Tytler, A. M. N. H.* (2) xiv, p. 173 (1854).
Mus tarayensis, plurimammis, *and* morungensis, *Hodgson, Horsfield, A. M. N. H.* (2) xvi, p. 112 (1855).
Nesokia indica, *Blyth, J. A. S. B.* xxxii, p. 328; *Jerdon, Mam.* p. 187; *Theobald, P. A. S. B.* 1866, p. 239; *Blyth, Mam. Birds Burma*, p. 38.
Mus (Nesokia) indicus, *Blyth, Cat.* p. 112, partim.
Mus (Nesokia) blythianus, barclayanus, *and* providens, *Anderson, J. A. S. B.* xlvii, pt. 2, pp. 225–231, pl. xiii.
Nesokia barclayana, *Blanford, Yark. Miss., Mam.* p. 46, pl. x *a*, fig. 1 (skull).
Mus (Nesokia) bengalensis, *Thomas, P. Z. S.* 1881, p. 526; *Anderson, Fauna Mergui Archip.* i, p. 341.

Yenkrai, Beng.; *Kok*, Can.; *Golatta koku*, Tel. of Yanádis; ? *Rekywek*, Burmese.

Fur coarse, sometimes with long black-tipped piles throughout the upper surface. Tail three quarters the length of the head and body or more. Mammæ 7 to 9 pairs. Feet hairy above. Skull longer and muzzle narrower than in *N. hardwickei*; anterior palatine foramina longer than the crowns of all the upper molar teeth. Incisors and molars narrower.

Colour dark brown above, slightly grizzled with yellowish; below hoary grey to isabelline. Basal fur dark ashy or blackish throughout; tips of dorsal hairs brownish yellow or isabelline, and of the longer piles black.

Dimensions. Head and body 6 to 9 inches, tail 5·5 to 7·25, ear about 0·75, hind foot 1·2 to 1·45. A large Calcutta male measured 8·2, 6·45, 0·83, and 1·3. Basal length of skull 1·7, zygomatic breadth 1·1.

Distribution. The greater part of the Indian Peninsula from the base of the Himalayas to Cape Comorin, and from Lower Sind to Cachar and I believe Assam; more common in damp alluvial tracts, but ascending to the tops of the Nilgiris and other hills. Found also in Ceylon and in the valley of Kashmir, and apparently throughout Burma to the Mergui Archipelago.

Varieties. The form from Southern India, *N. kok* v. *providens*, is smaller, usually paler in colour, and the anterior palatine foramina are very narrow. The Bengal variety is larger, and the Burmese form is larger still.

Habits. An excellent account has been given by Elliot, but is too long for extraction. Several details have also been supplied by Jerdon and Anderson.

Nesocia bengalensis lives in cultivated plains, gardens, and pastures, where its presence may be recognized by the piles of earth, resembling large mole-hills, at each opening of its burrow. Often the openings are in the banks of ditches and tanks or the bunds of rice-fields. The burrows, as in the case of *N. hardwickei*, are extensive and of irregular form, often branching, sometimes circular, and leading to a central chamber or nest, in which much grain is occasionally stored by the rat, a pound being sometimes found in a burrow. Jerdon observed burrows occupying an area 15 to 20 yards in diameter. Elliot found only one occupant to each burrow. The food consists chiefly of grass and other roots, and of grain where that is procurable.

This mole-rat is somewhat fierce, and when irritated it erects its long piles and utters a grunting sound. It takes freely to water and swims well. From 8 to 10 young are said to be usually produced at each birth, but 14 have been observed by Sterndale in an individual kept by him, and which he succeeded in taming perfectly, so as to come when called by her name.

Elliot says that the Wadáris or tank-diggers of the Deccan, who eat all rats, capture this species in large numbers for food, and in some favourable localities are able, at particular seasons, to subsist on its hoards of grain.

MINISTRY OF CULTURE · GOVERNMENT OF INDIA
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296. **Nesocia bandicota.** *The Bandicoot-Rat.*

Mus bandicota *and* indicus, *Bechstein, Allgem. Uebers. d. vierfüs. Thiere*, ii, pp. 713, 714 (1800).
Mus malabaricus *and* perchal, *Shaw, Gen. Zool.* ii, pt. 1, pp. 54, 55 (1801).
Mus giganteus, *Hardwicke, Trans. L. S.* vii, p. 306, pl. 18 (1804); *Kelaart, Prod.* p. 58.
Mus (Neotoma) giganteus, *Elliot, Mad. Jour. L. S.* x, p. 209.
Mus bandicota, *Blyth, J. A. S. B.* xx, p. 167, xxxii, p. 333, partim; *id. Cat.* p. 112; *Jerdon, Mam.* p. 193, partim.
Mus (Nesokia) giganteus, *Anderson, J. A. S. B.* xlvii, pt. 2, p. 232, pl. xiv, figs. *a–d.*
Mus (Nesokia) bandicota, *Thomas, P. Z. S.* 1881, p. 528.

Indúr, Sanscr.; *Ghous* or *Ghus*, H. and Mahr.; *Guru*, Kol.; *Heggin*, Can.; *Pandi koku*, Tel. of tank-diggers (pig-rat, whence the term bandicoot); *Ura-miyo*, Cing.

Size very large. Fur coarse, with long black-tipped piles, some of them often 2 or 3 inches long, on the upper parts. Ears moderate, rounded. Tail a little shorter than the head and body. Mammæ 12: 3 pairs pectoral, 3 pairs inguinal. Skull longer in proportion to the breadth than that of *N. bengalensis*; nasals broad and long, being about $\frac{2}{5}$ the length of the skull. Anterior palatine foramina as long as the row of upper molars or a little longer. Transverse laminæ of molars not straight but slightly wavy.

Colour above blackish brown, sometimes grizzled with pale yellowish or grey, especially on the sides; lower parts greyish brown or brownish grey. Dorsal fur light greyish brown or ashy at the base, then (in some specimens) whitish, the longer hairs with long black terminations. In old animals whitish tips are mixed. Feet above dark brown.

Dimensions. Head and body 12 to 15 inches, tail 11 to 13, hind foot 2·5; weight 2½ to 3 lbs. Basal length of a skull 2·6, zygomatic breadth 1·4.

Distribution. The Peninsula of India and Ceylon; not found in Lower Bengal, nor, I believe, in Sind or the Punjab; common in parts of Rajputana, and said to occur in the N.W. Provinces. Owing to large individuals of *M. decumanus* being mistaken for bandicoots, the present species has been incorrectly reported from several localities, Calcutta especially.

Habits. The bandicoot is, like other *Nesociæ*, a burrower. It is found about cultivated tracts and is common in villages and towns, especially in the south of India. I believe it is also found in forest. It is very destructive to grain, on which it feeds largely; it also consumes fruit, vegetables, &c., and it is said occasionally to kill fowls. When it is attacked (and when running about at night according to McMaster), it grunts like a pig, hence its Telegu name. McMaster has shown that it is sluggish and cowardly, and killed by a dog more easily than would be anticipated from its size. Sterndale succeeded in taming one individual completely.

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297. **Nesocia nemorivaga.** *The smaller Bandicoot-Rat.*

? Mus setifer, *Horsfield, Res. Java* (1824); *Cantor, J. A. S. B.* xv, p. 254; *Blyth, J. A. S. B.* xxiv, p. 712, xxxii, p. 334.
Mus (Rattus) nemorivagus, *Hodgson, J. A. S. B.* v, p. 234 (1836); *id. A. M. N. H.* xv, p. 266 (1845).
? Mus macropus, *Hodgson, A. M. N. H.* xv, p. 268 (1845).
Mus bandicota, *Blyth, J. A. S. B.* xxxii, p. 333, partim; *id. Mam. Birds Burma,* p. 39; *Jerdon, Mam.* p. 193, partim, *nec Bechstein.*
Mus (Nesokia) elliotanus, *Anderson, J. A. S. B.* xlvii, pt. 2, p. 231; pl. xiv, figs. *e–h* (1878).
Mus (Nesokia) nemorivagus, *Thomas, P. Z. S.* 1881, p. 529.

? *Mye-kywek,* Burm.

Fur softer than in *N. bandicota,* the long piles less developed, and the underfur denser and finer. Proportions similar, but size smaller. Mammæ 12. Skull intermediate in form between those of *N. bandicota* and *N. bengalensis*; nasals about ⅓ the length of the skull; anterior palatine foramina shorter than the upper molars together.

Colour. Dark brown above (black and brown mixed), paler or whity brown below. Basal half of fur ash-grey both above and below, tips on back pale brown, those of the longer hairs dark brown or black. Feet above dark brown.

Dimensions. Head and body of an adult female in spirit 9 inches, tail 7·8, hind foot 1·9, length of ear 0·9; basal length of skull 2·1, zygomatic breadth 1·2.

Distribution. Bengal (Purneah, Calcutta, where it is rare), Eastern Himalayas, Assam (Sibságar), and Khási hills; also Formosa. This species probably extends to Burma and the Malay countries.

Genus **ACOMYS,** Is. Geoffr. (1838).

Syn. *Acanthomys,* auct. *nec* Lesson.

Hinder part of the back covered with coarse, inflexible, flattened and grooved spines, without any hair intermixed. Mammæ 6: 1 pair axillar, 2 inguinal. Otherwise like *Mus,* from which the genus is doubtfully separable. Three or four species inhabit Western Asia and Northern Africa, and of these one has been found in Sind.

298. **Acomys dimidiatus.** *The pale spiny Mouse.*

Mus dimidiatus, *Rüppell, Atlas,* p. 37, pl. 13, fig. *a* (1826); *Wagner, Schreb. Säugeth. Supp.* iii, p. 440.

Sides, limbs, head, and lower parts covered with coarse hair. Tail about equal to the head and body in length, coarsely ringed, with short hair. Ears large, rounded. Feet short; planta coarsely granular near the toes, pads indistinct. Vibrissæ numerous.

Skull elongate. The mesopterygoid fossa opens about halfway between the molars and the bulla; pterygoids short, meeting anteriorly in an acute angle, diverging behind. Anterior palatine foramina very long, extending back to opposite the middle of the first molar. Molars broad and short, the first without an additional cusp.

Colour above sandy (very pale yellowish or rufescent brown), below white. No dark underfur. Vibrissæ white, except some of the uppermost.

Dimensions. Head and body 4 inches, tail 4, ear from crown 0·5, hind foot 0·75; length of skull 1·1.

Distribution. Egypt, Northern Arabia, and Palestine. A single specimen was obtained in Sind, at Laki, near Sehwan, by Mr. H. E. Watson.

Genus **GOLUNDA**, Gray (1837).

Syn. *Pelomys*, Peters (1852).

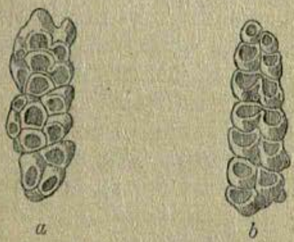

Fig. 134.—Upper (*a*) and lower (*b*) right molars of *G. ellioti*, × 3.

Head short and rounded. Ears rounded, tail hairy. Feet as in *Mus*. Molars low, broad, tubercular in the young, the worn surface exhibiting a peculiar pattern composed of semicircular lobes arranged in a triple row in the upper, and a double in the lower jaw. Upper incisors grooved. Bony palate narrow.

This genus occurs in Africa and India, one species being found in each area.

299. **Golunda ellioti.** *The Indian Bush-Rat.*

Golunda ellioti, *Gray, Charlesworth's Mag. N. H.* i, p. 586 (1837); *Kelaart, Prod.* p. 67; *Blyth, J. A. S. B.* xx, p. 167, xxxii, p. 350; *id. Cat.* p. 121; *Kelaart, Prod.* p. 67; *Jerdon, Mam.* p. 212; *Blanford, J. A. S. B.* xlv, pt. 2, p. 165, xlvi, pt. 2, p. 292.
Mus golundi *and* M. hirsutus, *Elliot, Mad. Jour. L. S.* x, pp. 208, 213 (1829).
Mus myothrix, *Hodgson, A. M. N. H.* xv, p. 267 (1845).
Golunda newera, *Kelaart, P. Z. S.* 1850, p. 158; *id. Prod.* p. 67; *Blyth, J. A. S. B.* xxxii, p. 352.
Golunda coffæus, *Kelaart, Blyth, J. A. S. B.* xxxii, p. 351.
Pelomys watsoni, *Blanford, P. A. S. B.* 1876, p. 181.

Gulandi, Can.; *Utu-elli*, Tam.; *Cofee-watte-meyo*, Cing.

Fur coarse, the longer piles much flattened and broadly grooved, but not spiny. Feet small, well clad above; 5 pads on fore foot, 6 on hind. Ears moderate, round, thinly clad with short hair. Tail stout at the base and tapering, shorter than the head and body, and thinly clad throughout with coarse hairs, short but much longer than in *Mus* generally. Mammæ 8: 2 pairs pectoral, 2 inguinal. Skull longitudinally convex above, with well-marked temporal crests. Anterior palatine foramina very long.

Colour above yellowish brown, not uniform, but finely speckled black and fulvous; below brownish white or grey. Basal half to three quarters of dorsal fur ashy grey to leaden black, the coarse hairs paler than the fine short underfur; most of the longer and coarser hairs have whity-brown or brownish-yellow terminations, but the tips of the longest hairs mixed with the others are black throughout. Tail dark brown above, pale below.

Dimensions of an adult female: head and body 4·55 inches, tail 4·1, ear 0·57, hind foot 0·85; basal length of skull 1·1, zygomatic breadth 0·55.

Distribution. Throughout the greater part of the Indian Peninsula and Ceylon. Recorded from Sind, Dagshai, Umballa, Satpura Hills, and many parts of the Bombay and Madras Presidencies. I feel some doubt about the Nepalese locality assigned to *Mus myothrix*. *G. ellioti* has not been observed in Bengal.

Habits. According to Sir W. Elliot, the gulandi lives entirely in the jungle, choosing its habitation in a thick bush, among the thorny branches of which, or on the ground, it constructs a nest of elastic stalks and fibres of dry grass, thickly interwoven. The nest is of a round or oblong shape, from 6 to 9 inches in diameter, and encloses a chamber about 3 or 4 inches across. The motions of this animal are somewhat slow, and it does not appear to have the same power of springing or leaping as other rats. Its food seems to be vegetable, the only contents of the stomach observed being roots of the dúb or hariyáli grass (*Cynodon dactylon*). Its habits are solitary (except when the female is bringing up her young) and diurnal, feeding in the mornings and evenings.

In Ceylon this rat has proved very destructive to coffee-trees, on the buds and blossoms of which it feeds. It appears, according to Kelaart, to migrate at times.

Subfamily CRICETINÆ.

Both lower and upper molars exhibiting biserial longitudinal structure, either rooted, with the tubercles on the crown in two longitudinal rows, or rootless, composed of subtriangular prisms arranged in a double line. Tail hairy and in all Indian species very short, less than half the length of the body.

To this subfamily belong the voles, hamsters, and some allied forms. The three genera represented within Indian limits are usually placed in three distinct subfamilies, *Arvicolinæ*, *Siphneinæ*, and *Cricetinæ*. All are Palæarctic, and the first and third Nearctic also. Within our area these rodents are confined to the Himalayas and Afghanistan. The genera may be thus recognized:—

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A. Molars rootless, elongate, composed of prisms.
  a. Ear-conch present .... MICROTUS.
  b. Ear-conch wanting.......................... ELLOBIUS.
B. Molars rooted, tubercular......................... CRICETUS.

Genus **MICROTUS**, Schrank (1798).

Syn. *Arvicola*, Lacépède (1801); *Hypudæus*, Illiger (1811); *Neodon*, Hodgson (1849); *Phaiomys*, Blyth (1863).

Head short, rounded; ears, tail, and limbs short. Fur soft and thick. The thumb (pollex) is short and sometimes clawless, more often it bears a short compressed claw. Nasal portion of skull short; brain-case oval, broad, and depressed; infraorbital foramen of the typical murine form; anterior palatine foramina long; interparietal large, pointed in the middle anteriorly; auditory bullæ moderately large. Incisors orange or yellow, flat in front; molars rootless, formed of subtriangular prisms biserially arranged, with sharp salient angles on each side, the number varying in the different species. The last upper and first lower molars vary more than the others.

The genus is Palæarctic and Nearctic, several species inhabiting the higher Himalayas. Of these I published a detailed account in 1881 (J. A. S. B. l, pt. 2, p. 88). From that account the following descriptions are abridged.

Synopsis of Indian and Burmese Species.

A. Thumb of fore foot clawless.
  a. Colour light ferruginous brown ...... *M. stoliczkanus*, p. 430.
  b. Colour light brown, with a grey tinge.. *M. stracheyi*, p. 431.
B. Thumb with a small claw.
  a. Ears not projecting beyond the fur.
    a′. Colour dark rich brown above, light brown below.................... *M. wynnei*, p. 431.
    b′. Colour rufescent brown, lower parts light brown .... *M. roylei*, p. 430.
    c′. Colour earthy brown, lower parts whitish .... *M. blythi*, p. 432.
  b. Ears projecting beyond the fur.
    a′. Colour light greyish rufescent brown; tail ½ head and body .... *M. blanfordi*, p. 432.
    b′. Colour dark yellowish brown; tail ⅓ head and body
      a″. Ear from orifice 0·5 in.; anterior lower molar with 6 internal angles *M. sikimensis*, p. 433.
      b″. Ear from orifice 0·35 in.; anterior lower molar with 5 internal angles *M. melanogaster*, p. 434.

Of these species, *M. blythi*, *M. sikimensis*, and *M. melanogaster* differ from all the others in the form of the molar teeth, and the two last named differ greatly from *M. blythi*. In the remaining five species the posterior upper molar terminates behind in an

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elongate lobe. For these species I proposed, in 1881, a subgeneric name *Alticola*. *M. sikimensis* and *M. melanogaster* belong to the subgenus *Neodon*.

300. **Microtus roylei.** *Royle's Vole.*

Arvicola roylei, *Gray, A. M. N. H.* x, p. 265 (1842); ? *Blyth, Cat.* p. 125; ? *Jerdon, Mam.* p. 216; *Blanford, J. A. S. B.* 1, pt. 2, p. 102 (1881).

Ears hairy, not projecting beyond the fur. Thumb with a claw. Tail nearly cylindrical, about one third the length of the head and body and covered with short hair. Last upper molar with 3 inner and 3 outer angles and terminating in an elongate lobe; first lower molar with 4 external and 5 internal angles.

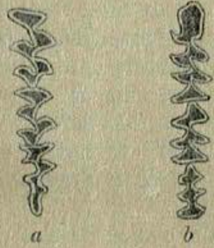

Fig. 135.—Crowns of (*a*) upper and (*b*) lower molars of *M. roylei*, × 4.

Colour rufous-brown on back, becoming yellower and paler on the sides and pale brown below; tail coloured like the back above, pale beneath. Basal half to two thirds of the fur leaden black, above and below; terminal portion on back light brown, becoming darker at the end, a few black tips intermixed.

Dimensions of dried skin: head and body 3 inches, tail without hair (vertebræ preserved) 1·1, hind foot 0·8.

Distribution. The type was from Kashmir. Jerdon observed voles on the Pir Panjal pass, also on the south side of Barendo pass N.E. of Simla, and near Chini, in Kunawar, at 12,000 feet elevation, but it is improbable that all belonged to the present species. The locality Pind Dadun Khan, given in Blyth's Catalogue, is a mistake. What Adams took for *Arvicolæ* in the Punjab Salt Range ('Wanderings of a Naturalist in India,' p. 152) remains to be ascertained.

Habits unknown. Jerdon found the Barendo pass species in large numbers, burrowing close to the surface in a meadow, and several were caught in digging a light trench round the tent.

301. **Microtus stoliczkanus.** *Stoliczka's Vole.*

Arvicola stoliczkanus, *Blanford, J. A. S. B.* xliv, pt. 2, p. 107 (1875); 1, pt. 2, p. 97; *id. Yark. Miss., Mam.* p. 42, pl. viii, fig. 1, pl. x *b*, fig. 2.

Ears small, completely concealed by the fur, hairy. Thumb rudimentary and clawless. Tail short, about a quarter of the head and body in length, covered with stiff hairs that extend half an inch beyond the end. Last upper molar with 2 strong inner and 4 weak outer angles, two close together near the front end of

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[illegible]e tooth, two also near together farther back on an elongate posterior lobe. First lower molar with 5 angles on each side, the anterior pair very small and blunt.

Colour above bright ferruginous brown, below pure white. Tail and feet white. Basal half to three quarters of the fur leaden black; terminal portion on the back rufous-white, tipped darker rufous, numerous rather longer dark rufous-brown tips intermixed.

Dimensions of dried skins: head and body 4 inches, tail without hair 1, hind foot with claws 0·7; length of skull about 1·15.

Distribution. Plateaus of Northern Ladak. One specimen obtained in the Nubra valley, and one at Aktágh on the Upper Yarkand River.

302. **Microtus stracheyi.** *The Kumaon Vole.*

Cricetus songarus, *Horsfield, Cat.* p. 145, nec *Pallas.*
Arvicola stracheyi, *Thomas, A. M. N. H.* (5) vi, p. 322 (1880); *Blanford, J. A. S. B.* l, pt. 2, p. 98.

Ears small, hairy, not extending beyond the fur. Thumb rudimentary and clawless. Tail short, about one fifth the length of the head and body, covered with short hair, the tip with longer, extending half an inch beyond the end. Last upper molar with 2 strong internal and 4 weak external angles, the latter in pairs, the posterior pair on the long narrow posterior lobe. First lower molar with 5 internal and 5 external angles, the anterior on each side ill-marked.

Colour above rather light brown, below white, tail nearly white. Base of fur blackish grey throughout, with, on the back, in the only specimen examined, a whitish ring in the middle of the dark portion (this may be an individual peculiarity): terminal portion of dorsal hairs whitish, becoming brown at the tips. Some black ends intermixed.

Dimensions of a dried skin: head and body 3·7 inches, tail without hair 0·7, hind foot 0·65.

Distribution. Kumaun. A specimen from Dharmsála is also referred to this species by Mr. W. Sclater.

303. **Microtus wynnei.** *The Murree Vole.*

Arvicola wynnei, *Blanford, J. A. S. B.* xlix, pt. 2, p. 244 (1880); l, pt. 2, p. 99.

Kanis, H.

Ears hairy, not extending beyond the fur. Thumb with a short claw. Tail $\frac{1}{3}$ to $\frac{1}{4}$ the length of the head and body, clothed with long hair at the base, and with short elsewhere. Hinder upper molar with 2 inner and 3 outer angles, the posterior outer angle ill marked, the tooth ends in a long narrow lobe. First lower molar with 5 inner and 4 outer angles.

Colour above varying from dark rich brown with a slight greyish tinge to dark chestnut, lower parts pale brown, tail coloured like the back. Base of fur leaden black throughout.

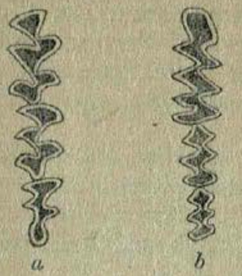

Fig. 136.—Crowns of (*a*) upper and (*b*) lower molars of *M. wynnei*, × 4.

Dimensions of a male in spirit: head and body 4·75 inches, tail 1·35, ear 0·25, hind foot 0·7; extreme length of skull 1·14, zygomatic breadth 0·75. Another male measures only 3 inches from nose to rump, tail 1·2.

Distribution. Murree, obtained by Mr. Wynne in the station.

A specimen with similar dentition to *M. wynnei*, but brown (not rufous) above, whitish below, with ears projecting considerably beyond the fur, was received without trustworthy locality, but associated with Kashmir specimens, at the British Museum.

304. **Microtus blanfordi.** *The Gilgit Vole.*

Arvicola blanfordi, *Scully, A. M. N. H.* (5) vi, p. 399 (1880); *id. P. Z. S.* 1881, p. 206; *Blanford, J. A. S. B.* l, pt. 2, p. 104.

Ears projecting beyond the fur, rounded, covered with short hair. Thumb very small, but with a small claw. Tail nearly half the length of the head and body, well clad with short hair. Hinder upper molar with 3 inner and 3 outer angles and terminating in a short longitudinal lobe. First lower molar with 5 inner and 4 outer angles.

Colour greyish brown above, white below; tail light brown above, sullied white beneath. Base of fur leaden black throughout, terminations on back pale brown, the tips darker, some longer black tips intermixed, especially on the rump.

Dimensions of a male fresh: head and body 4·55, tail 2·05, ear 0·7, hind foot 0·75.

Distribution. Gilgit, 9000 to 10,000 feet.

305. **Microtus blythi.** *Blyth's Vole.*

Phaiomys leucurus, *Blyth, J. A. S. B.* xxxii, p. 89 (1863); *id. Cat.* p. 125; *Theobald, J. A. S. B.* xxxi, p. 519; *Stoliczka, J. A. S. B.* xxxiv, p. 110, nec Arvicola leucurus, *Gerbe* (1862).

Arvicola blythi, *Blanford, J. A. S. B.* xliv, pt. 2, p. 107 (1875), l, pt. 2, p. 106; *id. Yark. Miss., Mam.* p. 39, pl. viii, fig. 2, pl. x *b*, fig. 1.

Phise, Ladak.

Ears hairy, not extending beyond the fur. Thumb with a short claw. Tail $\frac{1}{4}$ to $\frac{1}{3}$ the length of the head and body, covered with short hair. Last upper molar with 3 internal and 3 external angles and without any narrow posterior lobe. First lower molar with 5 inner and 4 outer angles, third with 3 inner but only 2 outer angles, other species having 3.

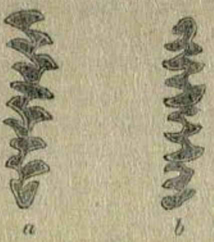

Fig. 137.—Crowns of (*a*) upper and (*b*) lower teeth of *M. blythi*, × 4.

Colour above earthy brown, not dark (yellowish brown with a greyish tinge); below brownish white; tail light brown. Base of fur above and below dark ashy grey, terminations on back grey-brown, with dark brown or black ends intermixed.

Dimensions of a fresh specimen: head and body 4 inches, tail 1·35; of another, a large female, 4·9 and 1·25. A skull is 1·03 in extreme length, and 0·67 in zygomatic breadth.

Distribution. Banks of Tsho Morari and Pankong lakes, Western Tibet, also between Leh and the Pankong lake at elevations above 13,000 feet. According to Stoliczka this vole is also found in Spiti, Lahul, and Kulu.

Habits. This vole was found by Mr. Theobald to make deep burrows on the banks of the Tsomoriri. In a female he found 6 young.

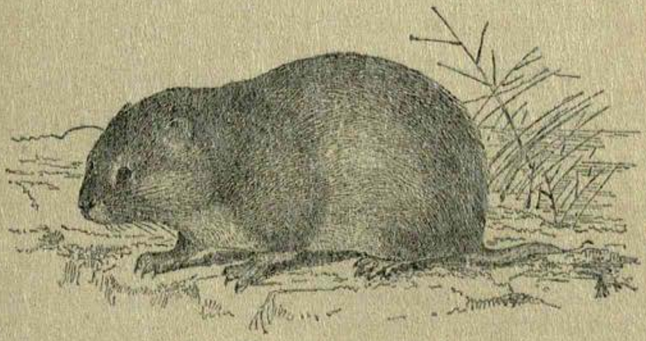

Fig. 138.—*Microtus blythi.*

Two species of vole, *M. mandarinus* and *M. guentheri* (the former related to *M. blythi*), have been obtained in Afghanistan.

306. Microtus sikimensis. *The Sikhim Vole.*

Neodon sikimensis, *Hodgson, Horsfield, A. M. N. H.* (2) iii, p. 203 (1849) (no description); *id. Cat.* p. 146; *Blyth, Cat.* p. 125; *Jerdon, Mam.* p. 217; *Blanford, Yark. Miss., Mam.* p. 41; *id. J. A. S. B.* l, pt. 2, p. 110.

Arvicola thricolis (thricotis), *Hodgson, Cat. Mam. &c., Nepal & Tibet, B. M.* 2nd ed. 1863, p. 10 (no description).

Phalchua, Nipalese; *Chik yu*, Karanti; *Sing phuchi*, Tibetan.

Ears thinly clad, projecting beyond the fur, which is of moderate length. Whiskers moderate. Tail thinly clad, tapering, one third the length of the head and body, or rather more. Mammæ 8: 2 pairs pectoral, 2 inguinal. Last upper molar with 4 internal and 3 external angles; no posterior lobe. First lower molar with 6 inner and 5 outer angles.

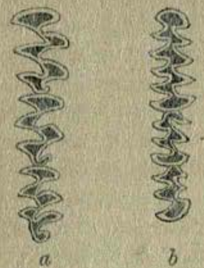

Fig. 139.—Crowns of (*a*) upper and (*b*) lower molars of *M. sikimensis*, × 4.

Colour dark brown, with a yellowish tinge above, below pale brown. Base of fur leaden black above, dark ashy below, tips on back light brown mixed with numerous black ends.

Dimensions of a fresh specimen: head and body 4·75 inches, tail 1·75, hind foot 0·75. In a female in spirit the ear from the orifice measures 0·5.

Distribution. Sikhim, between 7000 and 10,000 feet elevation.

Habits. This vole inhabits forests and, according to Hodgson, breeds in hollow decayed trees or amongst the roots of trees, making a nest of moss or soft grass. The female has 3 or 4 young at a time.

307. **Microtus melanogaster.** *Père David's Vole.*

Arvicola melanogaster, *M.-Edw. Nouv. Arch. Mus.* vii, *Bull.* p. 93 (1871); *id. Rech. Mam.* p. 284, pls. xliv, xlvi *a*; *Blanford, J. A. S. B.* l, pt. 2, p. 114.

Ears thinly clad, shorter than in *M. sikimensis*, projecting beyond the fur by one third of their length. Feet small. Last upper molar with 3 or 4 angles on each side, usually 3 well-marked and a fourth weak external angle on the U-shaped posterior termination of the tooth. Anterior lower molar with 5 external and 5 or 6 internal angles, the angles inside and outside sometimes nearly opposite to each other, not alternating.

Colour as in *M. sikimensis*. Some specimens are more rufous.

Dimensions of a male in spirit: head and body 3·7 inches, ear from orifice 0·37, tail 1·4, hind foot 0·6 (in a Bhámo specimen 3, 0·3, 1·4, and 0·65).

Distribution. South-western China (Fokien, Sechuen) and Moupin in Eastern Tibet. Mr. Thomas has identified this species amongst Mr. Fea's collections from the Kakhyen hills, near Bhámo.

Genus **ELLOBIUS**, Fischer (1814).

Syn. *Myospalax*, Blyth, 1846, nec Brandt, 1855.

No distinct ear-conch. Head very blunt and rounded. Body subcylindrical, feet broad. Claws 5—5, straight, compressed.

Tail very short, hairy. Skull very different from that of *Microtus*, the facial portion, zygomatic arches, and occipital crest being much more developed, and the brain-case rounded, not depressed, conoidal not oval in front, and with the occipital surface sloping backwards from above. Infraorbital foramen subtriangular, less narrowed below than in *Microtus*. Anterior palatine foramina very small, nearer to the molars than to the incisors; palate between molars hollowed out on each side. Bullæ small, depressed. Incisors white, protruding greatly forwards. Molars similar to those of *Microtus*.

One species occurs in Afghanistan, extending to Quetta. The only other clearly known form, *E. talpinus*, inhabits Central and Western Asia and Eastern Europe. *E. intermedius*, lately described by Scully from near Herat (J. A. S. B. lvi, pt. 2, p. 73), is referred to *E. talpinus* by Büchner (Mam. Przewalsk. p. 137) and to *E. fuscicapillus* by Thomas, with whom I agree. It is possible, as Büchner suggests, that *E. fuscicapillus* may be only a variety of *E. talpinus*, but the cranial distinctions are considerable.

308. **Ellobius fuscicapillus.** *The Quetta Vole.*

Georychus fuscocapillus, *Blyth, J. A. S. B.* x, p. 928 (1841) (no description), xi, p. 887 (1842).
Myospalax fuscocapillus, *Blyth, J. A. S. B.* xv, p. 141; *id. Cat.* p. 126.
Ellobius fuscicapillus, *Blanford, J. A. S. B.* l, pt. 2, p. 119; *O. Thomas, Tr. L. S.* (2), *Zool.* v, p. 59.

Fur soft and long. Tail very short, thinly clad with moderately long hair. Six pads on each hind foot, all elongate. In the zygomatic arch the malar does not extend to the lower edge, where the maxillary and squamosal processes meet. The first and second upper molars have each 3 inner and 3 outer angles, the third 2 inner and 3 outer and the tooth is but little shorter than the second. The first lower molar has 5 inner and 4 outer angles (the anterior angle on each side ill-developed), the second and third 3 on each side.

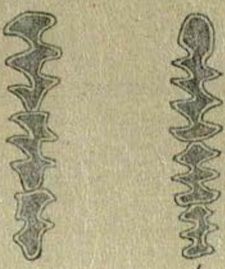

Fig. 140.—Crowns of (*a*) upper and (*b*) lower molars of *E. fuscicapillus*, × 4.

Colour pale rufescent sandy (brownish white) above, except the head, which is dark greyish brown. Lower parts, feet, and tail white. Basal three quarters or more of the fur above and below dark leaden grey. No black-tipped hairs on the back.

Dimensions. An adult female in spirit measures: head and body 4·7 inches, tail 0·5, hind foot 0·8; basal length of skull 1·3, zygomatic breadth 1.

Distribution. Originally obtained by Hutton at an elevation of

5500 feet around Quetta, where, however, it has not since been found. Specimens were brought by Dr. Aitchison from Northern Afghanistan.

Habits. This mole-like rodent was said by Hutton to make long horizontal galleries, marked by earth-heaps thrown out at intervals.

Genus **CRICETUS**, Cuv. (1800).

Internal cheek-pouches present. Form stout, head blunt; tail short, not scaly, sparsely haired. Incisors not grooved. Molars in both jaws with the tubercles arranged longitudinally in pairs, 3 pairs in the anterior molar, 2 in the second and third. The tubercles are worn down in old animals. Vertebræ: C. 7, D. 13, L. 6, S. 3, C. 17.

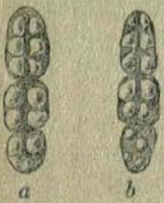

Fig. 141.—Crowns of (*a*) upper and (*b*) lower molars of *C. phæus*, × 5.

The hamsters are Palæarctic, but Thomas and others have shown (P. Z. S. 1888, p. 133) that the American genus *Hesperomys* must be united. The grey Central Asiatic forms, distinguished by A. Milne-Edwards as *Cricetulus*, have three representatives in Gilgit, but have hitherto not been found elsewhere within our limits.

Synopsis of Indian Species.

A. Head and body 3″·5 to 4″ long	*C. phæus*, p. 436.
B. Head and body about 4″·5 long	*C. fulvus*, p. 437.
C. Head and body about 5″·3 long	*C. isabellinus*, p. 437.

309. **Cricetus phæus.** *The little grey Hamster.*

Mus phæus, *Pallas, Glires*, pp. 86, 261, pl. xv *a* (1784).
Cricetus (Cricetulus) phæus, *Blanford, Yark. Miss., Mam.* p. 44; *id. J. A. S. B.* xlviii, pt. 2, p. 96; *Scully, P. Z. S.* 1881, p. 205.

Tail cylindrical, about one fourth the head and body in length. Feet short. Planta hairy, with 6 tubercles, all on the distal half. Ears rounded, thinly clad. Fur soft.

Colour ashy grey above, sometimes with a fulvous tinge, the back with a blackish wash. Lower parts white. Basal two-thirds of dorsal fur leaden black, tips of some hairs blackish.

Dimensions. Head and body 3·7 inches, tail 1, ear 0·75, hind foot 0·6; basal length of skull 0·95, zygomatic breadth 0·5.

Distribution. Widely spread in Central Asia; common in Persia, Turkestan, &c. Found in Gilgit by Biddulph and Scully from 5000 to 9000 feet elevation.

Habits. This hamster frequents cultivated lands and pastures and is frequently found in houses.

310. **Cricetus fulvus.** *The fulvous-grey Hamster.*

Cricetus (Cricetulus) fulvus, *Blanford, J. A. S. B.* xliv, pt. 2, p. 108 (1875), xlviii, pt. 2, p. 96; *id. Yark. Miss., Mam.* p. 45, pl. ix, fig. 1, pl. x *b*, fig. 3; *Scully, P. Z. S.* 1881, p. 205.

Precisely similar to the last in structure but larger.

Colour fulvous grey above, white below. More rufous or isabelline than *C. phæus*, but otherwise similar.

Dimensions. Head and body about 4·5 inches, tail 1·45, ear 0·6, hind foot 0·7; skull 1·17 long (total length), 0·64 broad.

Distribution. Káshghar, Yárkand, and the Pámir, extending to Gilgit, where it occurs with the last.

311. **Cricetus isabellinus.** *The large grey Hamster.*

Cricetus isabellinus, *De Filippi, Viaggio in Persia*, p. 344; *Scully, P. Z. S.* 1881, p. 205.

Precisely similar to *C. phæus* but much larger.

Colour greyish isabelline above, white below.

Dimensions. Head and body 5·35 inches, tail 1·1.

Distribution. Found by De Filippi at Tehrán, Northern Persia, and by Scully in Gilgit.

It is somewhat doubtful whether these three forms of *Cricetus* should be considered species or only varieties. *C. fulvus* is about double and *C. isabellinus* fully quadruple the weight of *C. phæus*. The different forms occur in several places, but this is not in favour of their being distinct.

Family SPALACIDÆ.

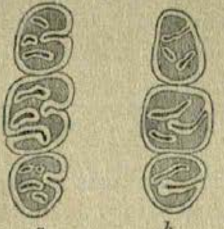

Fig. 142.—Crowns of (*a*) upper and (*b*) lower molars of *Rhizomys pruinosus*, × 2.

The *Spalacidæ* are sometimes called rodent moles, and resemble a mole in general aspect, having cylindrical bodies, short limbs, small eyes and ears, large claws, and a short or rudimentary tail. The infra-orbital opening is small or moderate, with no perpendicular plate; and the palate is narrow. The incisors are large, the molars rooted, with re-entering enamel folds.

A single genus, *Rhizomys*, inhabits South-eastern Asia and occurs in the Himalayas and Burma: other members of the family are Palæarctic or Ethiopian.

CSL

Genus RHIZOMYS, Gray, 1831.

Syn. *Nyctocleptes*, Temm.

Form robust; eyes very small; ears small and naked; thumb very small, rudimentary, but furnished with a claw. Tail almost naked, having only a few scattered hairs, and not scaly, about one fourth to one third the length of the head and body.

Dentition: i. $\frac{2}{2}$ m. $\frac{3-3}{3-3}$. The upper incisors are arched forward and both they and the lower incisors are usually deep orange in colour; occasionally, however, the upper incisors are white, the lower orange. There are no premolars. Vertebræ: C. 7, D. 13, L. ?, S. 4, C. 19 (in *R. badius*). There are 3 pairs of inguinal and 2 pairs of pectoral mammæ. The anatomy has been described by Anderson (An. Zool. Res. p. 314).

Three distinct forms occur within our limits. Remains of a fossil species have been found in the Siwalik beds.

Synopsis of Indian and Burmese species.

A. Head and body 7 to 8 inches; colour chestnut or dark brown, not grizzled .... *R. badius*, p. 438.
B. Head and body 10 to 14 inches; colour dark brown, grizzled .... *R. pruinosus*, p. 439.
C. Head and body 15 to 19 inches; colour dark ashy to light brown .... *R. sumatrensis*, p. 439.

312. **Rhizomys badius.** *The bay Bamboo-Rat.*

Rhizomys badius, *Hodgson, Calc. Journ. N.H.* ii, pp. 60, 410 (1842); *Blyth, J. A. S. B.* xii, p. 925; *id. Cat.* p. 122; *Jerdon, Mam.* p. 214; *Anderson, An. Zool. Res.* p. 329, pls. xiv, xvi; *Thomas, P. Z. S.* 1886, p. 65.

Rhizomys minor, *Gray, A. M. N. H.* x, p. 266 (1842); *Horsf. Cat.* p. 165; *Blyth, Mam. Birds Burma*, p. 41; *Anderson, An. Zool. Res.* p. 327, pls. xv, xvi.

Rhizomys castaneus, *Blyth, J. A. S. B.* xii, p. 1007 (1843); *id. Cat.* p. 123; *id. Mam. Birds Burma*, p. 41; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 165.

Yukron, Kakhyen; *Khai*, Burmese.

Fur soft and rather thick. Ears hidden by the fur. Foot-pads smooth, not tuberculated.

Colour chestnut, bay or ashy brown, but nearly uniform in each individual, rather brighter and deeper above than below. All the basal portion of the fur, two thirds to three fourths or more, dark cinerous or leaden grey. Sometimes there is a white spot on the forehead. In most young specimens and some adults the tips of the hairs are dull rufous or ashy brown (*R. minor*).

Dimensions. Head and body 7 to 9 inches, tail about 2·7, hind foot from heel 1·3, both sexes the same; basal length of skull 1·85,

CSL

zygomatic breadth 1·45. Some skulls appear smaller, one apparently adult measures 1·75 by 1·3.

Distribution. The base of the Eastern Himalayas in Nepal, Sikhim, and Bhutan; Assam, Manipur, and throughout Burma, also north of Burma in the hill-ranges near Bhámo, and in Siam.

Habits. This animal lives in burrows made by itself, sometimes, it is said, under roots of trees, elsewhere, as observed by Anderson, in high rank grass. It leaves its burrow in the evening and feeds on various vegetables, especially young shoots of grasses and cereals, and probably of bamboo. It is also said to feed largely on roots; indeed, Hodgson's view, from observations on a living animal, was that these were the principal object of its burrows. It burrows rapidly, using its powerful teeth as well as its claws in the process. Above ground the pace of *Rhizomys* is slow; the animal appears fearless, so much so that wild individuals are said to allow themselves to be captured without resisting, though ready enough to turn upon an assailant.

This and other species are eaten by many of the Burmese hill tribes.

313. **Rhizomys pruinosus.** *The hoary Bamboo-Rat.*

Rhizomys pruinosus, *Blyth, J. A. S. B.* xx, p. 519; *id. Cat.* p. 122; *id. Mam. Birds Burma*, p. 41; *Anderson, An. Zool. Res.* p. 325, pls. xiii, xvi.

Fur soft and thick, concealing the small ears. Foot-pads covered with tubercles.

Colour dark brown throughout, with a hoary or grizzled appearance owing to scattered whitish hairs, which are shorter, finer, and closer together on the lower surface, giving a somewhat silvery tone. Basal half of dorsal fur dark ashy, paler on the head. In old females the sides of the head, muzzle, and chin are pale brown.

Dimensions of a large male: head and body 13 inches, tail 4, hind foot from heel 2·2. In a smaller individual, a female, the corresponding measurements are 10·75, 3·75, and 1·95. Basal length of a skull 2·6, zygomatic breadth 2.

Distribution. Khási and other hills south of Assam, extending to the Kakhyen hills north of Upper Burma and to Karennee. There is also in the British Museum a skull from Cambodia and another from Swatow, China.

Habits. So far as known, similar to those of *R. badius.* The female produces three or four at a birth.

314. **Rhizomys sumatrensis.** *The large Bamboo-Rat.*

Mus sumatrensis, *Raffles, Tr. Linn. Soc.* xiii, p. 258 (1822).
Rhizomys sumatrensis, *Gray, P. Z. S.* 1831, p. 95; *Cantor, J. A. S. B.* xv, p. 255; *Blyth, J. A. S. B.* xxviii, p. 294; *id. Cat.* p. 122; *id. Mam. Birds Burma*, p. 41; *Anderson, An. Zool. Res.* p. 322.
Rhizomys cinereus, *McClelland, Calc. Jour. N. H.* ii, p. 456; *Blyth, J. A. S. B.* x, p. 920.

Rhizomys erythrogenys, *Anderson*, *P. A. S. B.* 1877, p. 150; *id. An. Zool. Res.* p. 324, pl. xiii *a*.

Pwe, Burmese; *Tikus bulo*, Malay.

Fur short and thin, with numerous coarse whitish hairs scattered through it on the back. Foot-pads covered with flattish tubercles. Skull thick and massive, muzzle broad.

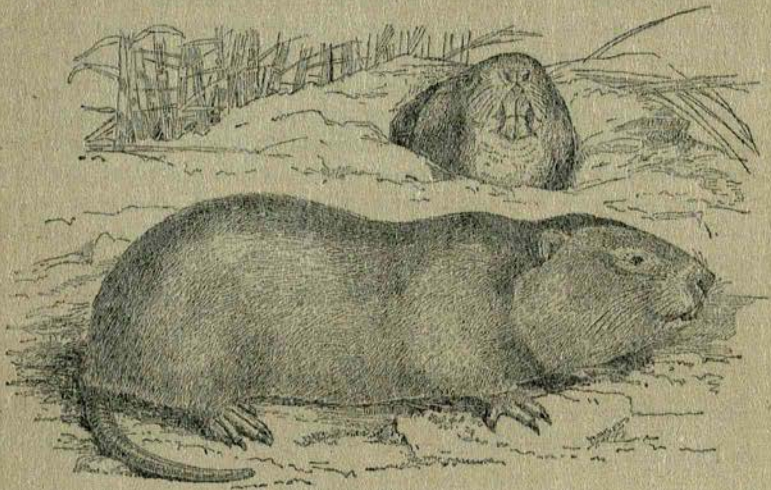

Fig. 143.—*Rhizomys sumatrensis* (after Anderson).

Colour varying from dark ashy grey or greyish brown to light brown or brownish buff or isabelline, the middle of the back darker and the lower parts paler. Sides of the head pale, or sometimes bright ferruginous red. There is occasionally a white frontal spot. The bright feruginous coloration of the cheeks, from which the name *erythrogenys* was derived, and the dark ashy tint of the back are, according to Cantor, signs of immaturity.

Dimensions. Head and body in a large male 19 inches, tail 5½. Other specimens 15 to 17 inches, tail 5 to 6. A skull measures 3·15 in basal length, 2·5 in zygomatic breadth.

Distribution. The Malay Peninsula and Siam, extending throughout the Tenasserim Provinces as far north as Moulmein, Shwegyeng, and Karennee.

Habits. Like the other species of the genus, this is doubtless a burrower, but scarcely anything appears recorded of its habits in the wild state.

The only Asiatic species not found in Burma or the Himalayas are the Chinese *R. sinensis* and *R. vestitus*, which Anderson regards as identical. The remaining species of the genus inhabit Abyssinia.

Family HYSTRICIDÆ.

The porcupines and their near allies constitute this family and are easily recognized by their fur being more or less completely modified into spines. Spines, it is true, occur is some other rodents, but not to the same extent.

The form is robust (the largest Indian rodents belong to this family) and the limbs subequal. The clavicles are imperfect in all Indian forms; the fibula distinct. The zygomatic arch is stout, the malar bone not supported below by a continuation of the maxillary zygomatic process. Infraorbital opening large. The angular portion of the mandible arises from the outer side of the bony socket of the lower incisor. Facial part of the skull short and broad. Molars with external and internal enamel plaits, semirooted in all Indian genera.

Two genera occur within Indian limits.

A. Tail short, spinose, with hollow quills at the end...... HYSTRIX.
B. Tail long, scaly, with a tuft of bristles at the end...... ATHERURA.

Genus **HYSTRIX**, L. (1766).

Syn. *Acanthion*, Cuv.; *Acanthochærus*, Gray.

Body covered with rigid spines, some longer flexible spines being added on the back, the stoutest spines attached to the loins and rump. Tail short, spinose, and having at the end a bundle of slender-stalked open quills. Muzzle blunt. Mammæ 6.

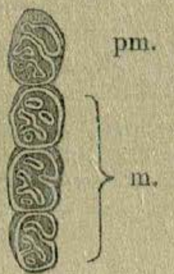

Fig. 144.—Crowns of right upper cheek-teeth of *H. leucura*, ×1.

In the skull the nasal bones are well developed, much more so, however, in some species than in others. There are large air-sinuses in the frontals. Nasal cavity usually very large.

Dentition: i. $\frac{2}{2}$, pm. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}$. The upper grinding-teeth with one internal and three or four external folds; the folds become, with wear, loops of enamel inside the margin of the tooth. Lower teeth similar but with the folds reversed.

Vertebræ: C. 7, D. 15, L. 4, S. 4, C. 10–12. Toes 5—5, the pollex small.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. A crest of bristles 6 to 12 inches long or more on neck and shoulders .... *H. leucura*, p. 442.
B. Crest present but less than 6 inches long .... *H. bengalensis*, p. 444.
C. Crest wanting or quite rudimentary .... *H. hodgsoni*, p. 444.

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One species of *Hystrix* is found fossil in the Pliocene Siwaliks and another in the Pleistocene cave-deposits of Kurnool.

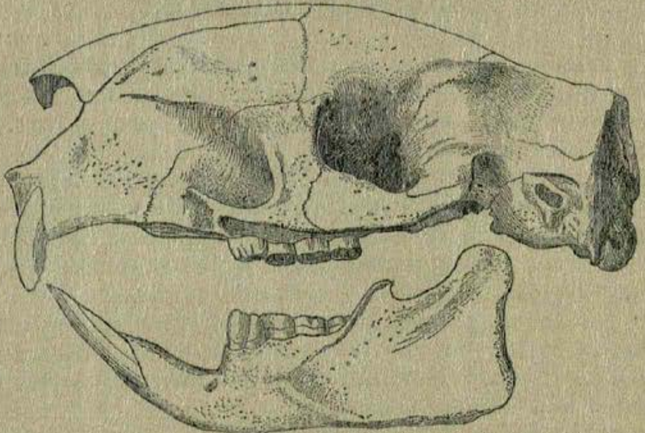

Fig. 145.—Skull of *Hystrix leucura*, × ½.

315. **Hystrix leucura.** *The Indian Porcupine.*

Hystrix cristata, var. indica, *Gray and Hardwicke, Ill. Ind. Zool.* ii, pl. 14 (1830).
Hystrix leucurus, *Sykes, P. Z. S.* 1831, p. 103; *Elliot, Mad. Jour. L. S.* x, p. 218; *Kelaart, Prod.* p. 70; *Adams, P. Z. S.* 1858, p. 520; *Blyth, Cat.* p. 128; *Jerdon, Mam.* p. 218.
Hystrix hirsutirostris, *Brandt, St. Petersb. Acad. Mem.* i, 1835, p. 375; *Waterhouse, Mammalia*, ii, p. 454; *Blyth, J. A. S. B.* xxi, p. 351.
Hystrix zeylonensis, *Blyth, J. A. S. B.* xx, p. 171 (1851).
Hystrix malabarica, *Sclater, P. Z. S.* 1865, p. 353, pl. xvi; 1871, pp. 233, 234.

Sáyi, *Sáhi*, *Sáyal*, *Sarsel*, H. &c.; *Sájru*, B.; *Dumsi*, *Chotia-dumsi*, Nepal; *Saori*, *Chaodi*, Guzrati; *Salendra*, Mahr. of the Ghâts; *Sinkor*, Sindhi; *Sikhan*, Baluch.; *Shkunr*, Pushtu; *Hoigu*, Gond.; *Jekra*, Korku; *Jiki*, Ho-Kol; *Yed*, *Múl-handi*, Can.; *Yeddu pandi*, Tel.; *Malánpani*, Tam. Mal.; *Hitava*, Cingalese.

A crest of very long coarse bristles, from 6 or 8 inches to occasionally over a foot in length, commencing on the forehead and extending along the spine to the middle of the back. Muzzle densely clad with hair; fore part of body, limbs, and abdomen covered with short spines mingled beneath with hair, the loins and base of tail with long spines, those situated anteriorly long and flexible, the others on the lower back and rump stout and rigid, so that the long flexible spines conceal the stouter quills except when all are erected. Skull moderately convex above, the nasals being nearly twice the length of the frontals, and having their lateral margins subparallel and their hinder border transverse; posterior

CSL

portion of premaxillary not differing greatly from a nasal in breadth. Mammæ 6, pectoral, laterally placed.

Colour blackish brown, with the exception of the tips of the quills on the cheeks and on a band across the throat (forming a collar), the terminal one fifth to one half, and one, two, or three narrow rings on the long dorsal quills, and all the spines and hollow quills of the tail, which are white. A few of the crest-bristles also are tipped with white or whitish in some individuals. The quills around the base of the tail are in great part white, and there is often a mesial line of white spines on the lower back. In some specimens the caudal spines and the tips and rings on the dorsal quills are partly orange-red instead of white.

Dimensions. Head and body 28 to 32 inches, tail 3 or 4, with spines 7 or 8, hind foot from heel 3·75; basal length of adult skull 5·5, zygomatic breadth 3·2. Weight 25 to 30 lbs.

Distribution. Throughout India and Ceylon, extending into the lower spurs of the Eastern Himalayas and to the westward far into the mountains, this species being found in Kashmir. A closely allied form, probably merely a variety *, extends throughout Western Asia to the Caspian and Black Sea. *H. leucura* has not been recorded east of the Bay of Bengal.

Habits. During the day the Indian porcupine remains in caves amongst rocks, or in burrows made by itself in hillsides, river-banks, bunds of tanks, &c. It has a predilection for rocky hills, and it is frequently gregarious. It rarely leaves its burrow till after sunset and generally returns thereto before sunrise. From being so thoroughly nocturnal, this, one of the commonest wild animals of India, is seldom seem. It feeds on vegetables, principally on roots, and is destructive to crops, especially to garden produce (peas, potatoes, onions, carrots, &c.), and to fruit, and is said to be very dainty and particular in its choice of food.

When irritated or alarmed porcupines utter a grunting sound and erect their spines with a peculiar rattling noise, produced, apparently, by the hollow tail-quills. When attacked by dogs or other animals, they charge backwards and inflict severe wounds with the rigid spines of their hind quarters. In confinement porcupines often gnaw, with their powerful teeth, through wooden cases or cages. They are fond of gnawing bones, and I have seen an elephant's tusk, found in the forest, deeply scored by their incisors. The flesh of the porcupine is well known to be excellent eating. From two to four young are produced at a birth, and are born with their eyes open and the body covered with short soft spines.

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* This is often called *H. cristata*, L. (as it was by myself in 'Eastern Persia, ii, p. 80). Waterhouse, however, 'Mammalia,' ii, p. 448, showed that the Italian and North African species must retain the Linnæan title. In true *H. cristata* the skull is very tumid, the nasals being enormous, more than 3 times the length of the frontals, much wider than the premaxillaries, and having together an oval contour.

316. **Hystrix hodgsoni.** *The crestless Himalayan Porcupine.*

Acanthion hodgsonii, *Gray, P. Z. S.* 1847, p. 101.
Hystrix alophus, *Hodgson, J. A. S. B.* xvi, p. 771, pl. xxxii (1847).
Hystrix hodgsoni, *Waterhouse, Mammalia,* ii, p. 461.
Hystrix longicauda, *Blyth, Cat.* p. 129, partim; *Jerdon, Mam.* p. 221, nec *Marsden.*

Anchotia dumsi, Nepalese; *Sathung,* Lepcha; *O-e,* Limbu; *Midi,* Cachari; *Subon-dem,* Manipuri; *Suku,* Kuki; *Sisi,* Daphla; *Tuigon, Soke, Liso, Vikhá, Sekru,* Naga.

No crests on head, neck, or shoulders as a rule, but occasionally a few bristles, slightly longer than the neighbouring spines, in a line on the back of the neck. Anterior portion of body, limbs, and abdomen covered with short flexible spines, flattened and deeply grooved, with hair-like terminations. Longer rigid spines and, scattered amongst them, still longer thin flexible spines, some of the latter often 10 inches in length, on the loins and rump. In the skull the nasals are about 2½ times the length of the frontals and have a convex posterior termination.

Colour dark brown, blackish on the limbs. A narrow band of white-tipped spines forms a collar in front of the neck; longer quills of the back having sometimes the base, sometimes the tip, sometimes both white. Tail-quills of black and white mixed.

Dimensions. Head and body 23 inches, tail 4, or with the quills 8; basal length of skull 4·4, zygomatic breadth 2·5. Weight 16 to 20 lbs.

Distribution. The lower slopes of the Himalayas in Nepal and Sikhim up to about 5000 feet, and Assam. A crestless porcupine inhabits Burma and other countries east of the Bay of Bengal, but whether the present species or *H. longicauda* is uncertain.

Habits. According to Hodgson these porcupines are monogamous, living in burrows, and resembling *H. leucura* in habits and food. They breed in spring and produce usually two young. The flesh is excellent and is much esteemed.

317. **Hystrix bengalensis.** *The Bengal Porcupine.*

Hystrix bengalensis, *Blyth, J. A. S. B.* xx, p. 170 (1851); *id. Cat.* p. 128; *id. Mam. Birds Burma,* p. 42; *Jerdon, Mam.* p. 220.

Sajru, Bengali: *Phyu,* Burmese.

This resembles *H. hodgsoni* and *H. longicauda* in size and general character, having only a very few long and slender quills intermixed with the ordinary weapon-quills. The latter are much longer and thicker than in *H. hodgsoni,* and the body-spines are still flatter and more strongly grooved and terminate towards the neck in slight setæ, towards the quills in rigid points. There is a distinct but small thin crest, the longest bristles of which measure 5 or 6 inches and are tipped with white for the terminal third; and the white demi-collar is strongly marked. General colour as in

GSL

H. hodgsoni, the quills generally having the basal half white, the rest black, most of them with a white tip more or less developed, the few long and flexible quills white with a narrow black band about the middle. Tail as in *H. hodgsoni*.

The above is an abridged copy of Blyth's original description. Jerdon gives the length of the head and body as 28 inches, tail 4.

Distribution. Lower Bengal, Assam, Arrakan, and probably Burma generally. Specimens have also been brought from Sikhim.

I have not been able to examine a specimen of this species. Anderson (An. Zool. Res. p. 333) describes the skull as closely resembling that of *H. longicauda* (Marsden, History of Sumatra, p. 118, pl. xiii), with which *Acanthochœrus grotei* of Gray (P. Z. S. 1866, p. 310) is said to be identical (see Sclater, P. Z. S. 1871, p. 234). Mr. Thomas has shown to me a skull with broad nasals collected by Mr. Fea in Karennee, and agreeing fairly with Anderson's description of that of *H. bengalensis*. The frontals are about half the length of the nasals, and the breadth of the nasals in front is nearly the length of the frontals. Basal length 4·75 inches, zygomatic breadth 2·7. As I find a rudimentary crest in some specimens of *H. hodgsoni*, the presence or absence of a small crest is not a specific character.

The skulls of *H. longicauda* (from Malacca, identified by Cantor) and *H. bengalensis* differ from that of *H. hodgsoni* in having the nasal bones not more than twice the length of the frontals. The crestless *H. javanica*, Cuv., from Java, and the small crested *H. yunnanensis* (Anderson, An. Zool. Res. p. 332), from Yunnan, have the frontals nearly as long as the nasals.

The remaining Asiatic forms of *Hystrix* besides *H. yunnanensis* and *H. javanica* are the Chinese *H. subcristata*, Swinhoe (P. Z. S. 1870, p. 638), and *H. crassispinis*, Günther (P. Z. S. 1876, p. 736, pl. lxx), from Borneo. *H. muelleri*, Jentink (Notes Leyd. Mus. 1879, p. 87), from Sumatra, is identical with *H. longicauda* of Cantor and others.

Genus **ATHERURA**, Cuv. (1829).

Tail elongate, about half the length of the head and body, scaly, with spiny bristles between the scales, and furnished with a tuft of long bristles partly flattened at the end. Spines of body flattened and grooved throughout, those of the lumbar region and rump not greatly exceeding those of the shoulders in length.

Skull much as in *Hystrix*, but the nasal cavity is smaller and the nasal bones shorter than the frontals. Dentition as in *Hystrix*.

But a single species is found within Indian limits and this is restricted to the countries east of the Bay of Bengal. Formerly, however, the genus must have existed in the Indian Peninsula, for its teeth have been found in the Pleistocene cave-deposits of Kurnool.

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318. Atherura macrura. *The Asiatic brush-tailed Porcupine.*

Hystrix macroura, *L. Syst. Nat.* i, p. 77 (1766).
Hystrix fasciculata, *Shaw, Gen. Zool.* ii, p. 11; *Gray and Hardw. Ill. Ind. Zool.* ii, pl. 15.
Atherura fasciculata, *Cantor, J. A. S. B.* xv, p. 257; *Blyth, Cat.* p. 129; *id. Mam. Birds Burma*, p. 43; *Sclater, P. Z. S.* 1871, p. 236.
Atherura macrurá, *Waterhouse, Mammalia*, ii, p. 472; *Blyth, J. A. S. B.* xx, p. 519; *Günther, P. Z. S.* 1876, p. 742; *Thomas, P. Z. S.* 1886, p. 71.

Lándak, Malay.

Body covered with rigid spines above, those of the lumbar region longer and mixed with a few still longer flexible bristle-like spines; head and lower parts covered with soft flattened spines. The tail is spiny near the base, then scaly, spiny bristles emerging between the scales, at the tip is a tuft of longer bristles, partly simple, but chiefly each composed of three or four elongate elliptical flattened disks joined together end to end, and to the tail by short bristles.

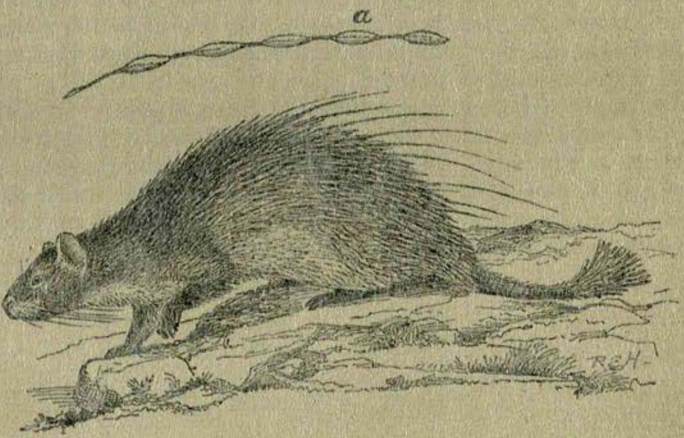

Fig. 146.—*Atherura macrura*; *a*, one of the bristles at the end of the tail.

Colour above dark brown, either uniform or with the tips of the spines paler; the long lumbar bristles mostly white, lower parts and bristles at the tip of the tail whitish.

Dimensions. Head and body of a male 22 inches, tail 10, of a smaller specimen 18·5 and 9; basal length of skull 3·4, zygomatic breadth 1·8.

Distribution. Burma and the Malay countries, extending northward to Chittagong, Tipperah, and the Khási hills, and southward to Java, Sumatra, and perhaps Borneo.

Habits. Similar to those of *Hystrix.*

CSL

The only remaining species of the genus, *A. africana*, occurs in Western and Central Africa. Another Oriental genus is *Trichys*, of which one species, *T. guentheri*, inhabits Borneo. The American porcupines belong to a distinct subfamily, *Synetherinæ*.

Suborder *DUPLICIDENTATA*.

This suborder, distinguished by having two pairs of upper incisors in adults, the smaller additional pair being behind the usual rodent teeth, not at the side of them, comprises two families—the hares and the *Lagomyidæ*, sometimes known as Pikas, calling or piping hares, or mouse-hares. In all there are, at birth, three pairs of upper incisors, but the outer tooth on each side is soon lost. Enamel extends all round the incisors. The molars are rootless, with transverse enamel-folds. The anterior palatine or incisive foramina are very large, usually confluent, and extending back to the premolars; the bony palate is very short; and the opening of the posterior nares is between the true molars. There is no true alisphenoid canal. The fibula is anchylosed to the tibia and articulates with the os calcis. The testes are permanently external to the abdominal cavity. All the species are exclusively vegetable feeders and have very long intestines and a large cæcum. All are terrestrial, none arboreal or aquatic.

Both families occur in India and are thus distinguished:—

Ears long; a tail present	**Leporidæ.**
Ears short, rounded; no tail..................	**Lagomyidæ.**

Family LEPORIDÆ.

Hares and rabbits compose this family. The ears are long, usually about the same length as the skull or longer, and there is a short tail. The limbs are long, the hind limbs in general conspicuously longer than the fore. The eyes are large and there are no eyelids. The skull is compressed; the frontals are broad between the orbits and furnished with peculiarly shaped postorbital processes, narrow where joined to the frontals, then expanded and forming the upper rim of the orbit. The clavicles are imperfect.

Dentition: i. $\frac{4}{2}$, pm. $\frac{3-3}{2-2}$, m. $\frac{3-3}{3-3}$. Toes 5–4. Vertebræ: C. 7, D. 12, L. 7, S. 4, C. 13–15.

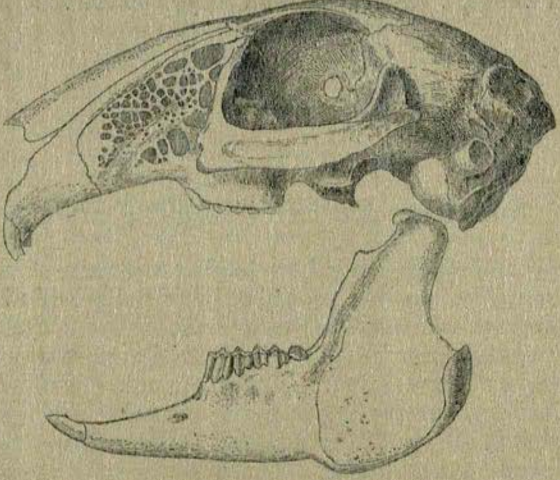

Fig. 147.—Skull of *Lepus nigricollis*, × $\frac{3}{4}$.

But a single genus is usually recognized in this family. Hares are found in all geographical regions except the Australian.

Genus **LEPUS**, L. (1766).

Syn. *Caprolagus*, Blyth (1845).

Characters of the family. Hares are well known and scarcely require description. There are several Indian species, some found in tropical parts of the country, others confined to the Himalayas. As a rule two different species do not inhabit the same area, but *L. ruficaudatus* and *L. hispidus* may form an exception, as both apparently occur in Eastern Bengal and Assam.

Hares have much resemblance to each other in habits; as a rule they dwell in grass, or amongst bushes or rocks, each living solitarily in a particular spot, known as its *form*; usually a mere seat in the grass, or beside a bush or stone. To this form the animal returns, sometimes daily, for a considerable period, changing, however, with the season of year. Hares move about and feed in the morning and evening and at night, living entirely on grass and other plants. They are swift of foot, and owing to the length of their hind legs can ascend a slope at great speed. True hares do not burrow. They breed several times in the year; the period of gestation is about a month, and the young are born with their

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eyes open and are able to reproduce at the age of about 6 months. In the European hare the young of the same litter are said to be sometimes dropped at considerable intervals. Rabbits differ from hares considerably; they dwell in burrows, and the young are born naked and with the eyes closed. The curious hispid hare also burrows.

Synopsis of Indian, Ceylonese, and Burmese species.

A. Ears as long as the head or longer, tail white beneath.	
a. A black patch on the back of the neck	*L. nigricollis*, p. 449.
b. No black patch.	
a'. Upper surface of tail rufous-brown; fur harsh	*L. ruficaudatus*, p. 450.
b'. Upper surface of tail blackish brown; fur soft	*L. dayanus*, p. 451.
c'. Upper surface of tail black.	
a''. General colour distinctly rufous ..	*L. peguensis*, p. 451.
b''. General colour not rufous	*L. tibetanus*, p. 452.
d'. Tail wholly or almost wholly white.	
a''. Ear longer than hind foot with tarsus	*L. oiostolus*, p. 452.
b''. Ear not longer than hind foot with tarsus	*L. hypsibius*, p. 453.
B. Ears shorter than head, tail brown throughout; fur bristly	*L. hispidus*, p. 454.

319. **Lepus nigricollis.** *The black-naped Hare.*

Lepus nigricollis, *F. Cuv. Dict. Sc. Nat.* xxvi, p. 307 (1823); *Elliot, Mad. Jour. L. S.* x, p. 218; *Kelaart, Prod. F. Z.* p. 72; *Blyth, Cat.* p. 132; *Jerdon, Mam.* p. 225.

Khargosh, H.; *Sassa*, Mahr.; *Malla*, Can.; *Musal*, Tam.; *Kundeli, Chourapilli*, Tel.; *Moilu*, Mal.; *Hava*, Cing.

Ears thinly clad. Fur somewhat harsh and coarse.

Colour above rufescent brown and black mixed, except a large black or brownish-black patch on the back of the neck, extending from the ears to the shoulders. Tail rufous-brown above, blackish towards the end. Fore neck, breast, and limbs rufous; chin, throat, and lower parts from fore limbs white, the dorsal and ventral tints passing gradually into each other on the flanks. Ears outside brown anteriorly, grey posteriorly, dusky towards the tip, narrowly margined with whitish inside. Dorsal fur ash-grey or creamy white at the base, then black, then rufous or rufescent white, the extreme tips black. Animals from the Nilgiri hills and Ceylon are more richly coloured than those from the plains, but one Nilgiri skin, sent to me by Mr. Hampson, is blackish brown above and not rufous.

Dimensions. Head and body 19 inches, ears 4·75, tail (without hair?) 2·5; a skull measures 2·9 in basal length and 1·65 in breadth across the zygomatic arches. Nilgiri hares weigh 5 to 8 lbs., but

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in the plains the weight is less, Col. Hamilton (Hawkeye) says 5 to 7.

Distribution. The Indian Peninsula, south of the Godávari, and Ceylon. This hare ascends hills and is found commonly on the Nilgiris and at Newera Ellia.

Habits. Nothing particular appears to have been recorded. Like *L. ruficaudatus*, this hare takes refuge in holes (on the Nilgiris, in hollow trees) when pursued, and like that species appears to have fewer young at a birth than the European hare. Mr. Davison tells me he has generally found one but not unfrequently two. On the Nilgiris this hare breeds chiefly from October to February.

320. **Lepus ruficaudatus.** *The common Indian Hare.*

Lepus ruficaudatus, *Geoff. Dict. class. d'hist. nat.* ix, p. 381 (1826); *Blyth, J. A. S. B.* xi, p. 100; *Cat.* p. 131; *Jerdon, Mam.* p. 224.
Lepus timidus, *McClelland, P. Z. S.* 1839, p. 152, nec *Linn.*
Lepus macrotus, *Hodgson, J. A. S. B.* ix, p. 1183 (1840); *Adams, P. Z. S.* 1858, p. 520; *Wagner, Hügel's Kaschmir*, iv, p. 574, pl.
Lepus aryabertensis, *Hodgson, Calc. Jour. N. H.* iv, p. 293.
Lepus tytleri, *Tytler, A. M. N. H.* (2) xiv. p. 176 (1854); *Blyth, J. A. S. B.* xxii, p. 415, xxiv, p. 471.

Khargosh, P. & Hindustani; *Khará, Susra* or *Sassa*, H. & B.; *Lambha* or *Lambhána*, H.; *Malol*, Gond.; *Kulhai*, Kol, Santál; *Koarli*, Korku; *Manye*, Paharia of Rajmehál.

Ears very thinly clad. Fur somewhat harsh and coarse; three pairs of mammæ, 1 pectoral, 2 inguinal.

Colour above light rufous-brown mixed with black on the back and face; breast and limbs rufous; chin, upper throat, and lower parts from between the fore legs white. Fur of back creamy white (sometimes very pale ashy grey) at the base, then for a short distance dark brown to ashy brown, then pale rufous, and the extreme tips black. Tail above rufous-brown. Anterior outer and posterior inner surface of ears more thickly clad than the remainder of the ear-conch, dark brown mixed with rufescent. Near their tips the ears are narrowly bordered with black outside and with rufous inside.

Dimensions. Head and body 18 to 20 inches, tail with hair 4, ear from crown 5, breadth laid flat 2·75, hind foot and tarsus from heel to end of claws 4; basal length of skull 2·9, zygomatic breadth 1·55; weight 4 to 5 lbs. Males are smaller than females.

Distribution. Northern India generally, except in Western Rajputana, Sind, and the South-west Punjab. This species ranges from the foot of the Himalayas to the Godávari or somewhat further south, being found, I believe, around Poona in the Deccan. To the eastward *L. ruficaudatus* occurs in Assam, to the north-west I have a specimen from Hazára.

Habits. This hare is chiefly found in waste ground or dry cultivation, amongst grass and bushes. It is common in many parts of Northern India, is often shot and occasionally coursed with greyhounds. When pursued it not unfrequently takes refuge in a fox's hole or some other burrow. In more than one instance, I have found a single fœtus in the female; Hodgson, however, found two and states that this is the number of young generally produced at a birth.

The flesh is not so good as that of the European hare, though much of the usual inferiority is probably due to cookery. When jugged this hare is by no means unpalatable.

321. **Lepus dayanus.** *The Sind Hare.*

Lepus dayanus, *Blanford, P. Z. S.* 1874, p. 663.
Lepus joongshaiensis, *Murray, Vertebrate Zoology of Sind,* p. 51.

Sassa, Saho, Seher, Sindhi.

Ears thinly clad. Fur very soft. In the skull the nasals are shorter and much less bent over anteriorly at the sides than in *L. ruficaudatus.*

Colour above light greyish brown mixed with black; breast and limbs pale rufescent, lower parts except the breast white. Dorsal fur at base light grey to creamy white, paler posteriorly, beyond the middle of each hair is a black ring, then a whitish space, the tip being black. Tail blackish brown above. Face-stripes whitish; around eyes white. Margin of ear near the tip blackish brown outside, buff inside.

Dimensions. Head and body 17 inches, tail with hair 4, without hair 2·75, ear from crown 4·5, hind foot and tarsus 4; basal length of skull 2·75, zygomatic breadth 1·6.

Distribution. Sind and Cutch, with the greater part of the Indian desert east of the Indus, probably also the Deraját in the Punjab.

Habits. Similar to those of *L. ruficaudatus.* This is, however, more of a desert form. It is much greyer than *L. ruficaudatus* and at once distinguished by its soft fur, and by the upper surface of the tail being blackish brown instead of rufous.

322. **Lepus peguensis.** *The Burmese Hare.*

Lepus sinensis, *Blyth, J. A. S. B.* xxi, p. 350, nec *Gray.*
Lepus peguensis, *Blyth, J. A. S. B.* xxiv, p. 471 (1855); *id. Cat.* p. 132; *id. Mam. Birds Burma,* p. 43.

Yun, Phu-goung, Burmese.

Colour above rufous mixed with black, below white, the two colours well defined, not passing into each other. Dorsal fur pale grey or white at the base, then black, terminal portion fulvous brown with black tips. Tail black above. Towards the rump there is sometimes a strong ashy tinge on the back. A large blackish terminal patch on the posterior outer surface of each ear.

Dimensions. Head and body 21 inches, tail with hair 4, ear 4·25, hind foot 4·5 (Tickell). A female skin in spirit is smaller, hind foot 4·1; the skull measures—basal length 2·7, extreme length 3·4, zygomatic breadth 1·6.

Distribution. Burma; in the Irrawaddy valley as far down as Henzada, wanting near the coast and in dense forest. Not recorded from Arrakan, but found to the southwest as far as the Thoungyin valley west of Moulmein (Stray Feathers, ix, p. 141) and perhaps farther south. I am indebted to Major Bingham for a good skin of this species, of which there was until recently no specimen in Europe.

323. **Lepus tibetanus.** *The Afghan Hare.*

Lepus tibetanus, *Waterhouse, P. Z. S.* 1841, p. 7, *id. Mammalia,* ii, p. 58; *Günther, A. M. N. H.* (4) xvi, p. 228 (1875); *Blanford, Yark. Miss., Mam.* p. 63; *Scully, P. Z. S.* 1881, p. 207.
Lepus craspedotis, *Blanf. Eastern Persia,* ii, p. 80, pl. viii.
Lepus biddulphi, *Blanf. J. A. S. B.* xlvi, pt. 2, p. 324.

Ears broad. Fur soft.

Colour above varying from light greyish to light rufescent brown mixed with black, the rump sometimes with an ashy tinge; lower parts white, except the breast which is light brown. Tail with a broad black band above. Dorsal fur ashy at the base, varying in depth of tint, passing into whitish, then black or dark brown followed by a very pale brown ring and the extreme tip black. Often, in winter fur, longer fine black-tipped hairs are intermixed on the back. Outside of the ears brown in front, behind buff, passing into black at the tip. In most specimens the ear-conch is margined with buff.

Dimensions. Head and body 19 inches, tail 3·5 (with hair 5), ear 5, breadth of do. 3, hind foot and tarsus 4·8. Weight 3½ lbs. The skull is 2·75 inches in basal length and 1·7 in zygomatic breadth.

Distribution. The upper Indus valley (Little Tibet), the greater part of Afghanistan, and Baluchistan. This hare is found as low as 500 feet above the sea in the latter (*L. craspedotis*). I have shot it on the Khirthar range west of Sind and near Quetta.

324. **Lepus oiostolus.** *The woolly Hare.*

Lepus oiostolus, *Hodgson, J. A. S. B.* ix, p. 1186 (1840), xi, p. 288.
Lepus pallipes, *Hodgson, J. A. S. B.* xi, p. 288, pl. (1842), *Blanford, Yark. Miss., Mam.* p. 62.
? Lepus tibetanus, *Blanf. J. A. S. B.* xli, pt. 2, p. 34, *nec Waterhouse.*

Rigong, Tibetan.

Ears densely clad outside and exceeding the head in length. Fur soft, thick, woolly, slightly curled in adults, more so in the young. Postorbital processes in the skull large, broad, and bent upwards, so that the frontal area between the orbits is broad and concave.

Colour above light yellowish brown mixed with dark brown, rump

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ashy grey. Tail almost entirely white, a few ashy hairs above near the base. Some of the fur on the back of the neck is tipped with ashy. Fore neck and breast pale rufescent, chin and abdomen white. Dorsal fur ashy at the base on the shoulders, white in the middle of the back, then dark brown or black followed by light brown, the tips of the longer hairs black. Ears externally dark brown in front, white behind, passing into ashy towards the base and black close to the tip, the border of the ear buffy white almost throughout; inside of ear-conch with short brown hair near posterior margin, except near the tip, where the hair is white. Eye-stripe whitish, whiskers mixed black and white. The young is pale brownish or slaty grey above.

Dimensions. Head and body 22 inches, ear 4·75, hind foot and tarsus 4·5, tail without terminal hair 4, with it 6; zygomatic breadth of skull 1·5.

Distribution. Tibet north of Nepal and Sikhim and probably farther east at high elevations. *L. oiostolus* occurs also in some of the high valleys south of the main range; I have seen it in Sikhim near the Kongra Lama pass.

This species is closely allied to *L. variabilis*, of which it and *L. hypsibius* may perhaps ultimately both prove to be varieties.

325. **Lepus hypsibius.** *The upland Hare.*

? Lepus oiostolus, *Adams, P. Z. S.* 1858, p. 520, nec *Hodgson.*
Lepus pallipes, *Blyth, Cat.* p. 131, nec *Hodgson.*
Lepus hypsibius, *Blanford, J. A. S. B.* xliv, pt. 2, p. 214 (1875); *id. Yark. Miss., Mam.*, p. 60, pl. iii, fig. 1, pl. iv *a*, fig. 1.

Fur long, woolly, curly, and very thick, the hairs of the rump nearly 2 inches long in winter. Ears scarcely exceeding the head in length. Postorbital processes of skull large and bent upwards.

Colour above rufous-brown, mixed with black on the back, rump dark ashy. Tail entirely white. Lower parts white, except the breast which is rufescent. Fur ashy at the base on the shoulders, creamy white in the middle of the back, then there is a blackish ring followed by a longer pale brown one, the extreme tip black. Hair of rump ashy grey throughout, some piles black-tipped. Outer surface of ears brown in front, whitish behind, with the extreme tip black.

Dimensions from dried skins. Head and body 24 inches, ear 4·5, hind foot and tarsus 5; basal length of skull 2·8, zygomatic breadth 1·73.

Distribution. The higher plains of Ladák such as Changchemno, and also of Rukshu. Not known to occur below 14,000 or 15,000 feet elevation.

This may be a variety of the last, but appears to be considerably larger with shorter ears.

326. Lepus hispidus. *The hispid Hare.*

Lepus hispidus, *Pearson, McClelland, P. Z. S.* 1839, p. 152; *Hodgson, J. A. S. B.* xvi, p. 572, pl. xiv; *Blyth, Cat.* p. 133; *id. J. A. S. B.* xxii, p. 415; *Jerdon, Mam.* p. 226.
Caprolagus hispidus, *Blyth, J. A. S. B.* xiv, p. 249, plates.

Ears very short, shorter than the skull. Eyes small. Fur coarse, bristly; underfur fine with the coarse longer hairs intermixed. Hind legs short, but little exceeding the fore legs in length. Claws strong. Mammæ 6. Skull very thick, flat above; frontals longer and nasals shorter than in other hares. Postorbital processes small, united to the frontals anteriorly; incisive foramina small; bony palate as long as broad. Teeth large.

Colour above black mixed with brownish white, producing a general dark brown aspect, and passing on the sides gradually into the sullied brownish white of the lower parts. The rump is more rufescent in some skins. Tail brown throughout, darker above. Basal half of dorsal fur greyish brown; terminal portion at first dark brown or black, then yellowish white followed by a long black tip sometimes interrupted by a second pale ring. Ears brown outside throughout. Breast a little darker brown than the abdomen.

Dimensions. Head and body 19 inches, tail 1·1, with hair 2·1, ear 2·75, hind foot and tarsus 3·9; basal length of skull 3, zygomatic breadth 1·75. Weight 5½ lbs.

Distribution. The tract along the foot of the Himalayas from Gorakhpur to Upper Assam. The hispid hare does not range into the mountains, but is said to be found as far south as the Rajmehal hills, Dacca, and, according to Hodgson, Tipperah.

Habits very imperfectly ascertained. According to Hodgson the hispid hare inhabits the *Sál* forest, whilst Jerdon states with more probability that it is found in the Terai (that is, of course, the marshy tract usually thus called), frequenting long grass, bamboos, &c. It is said to burrow like a rabbit, but not to be gregarious. Its food, as Hodgson was informed by the Mechis, consists chiefly of roots and the bark of trees. The flesh is said to be white.

This hare should perhaps be placed in a distinct genus *Caprolagus* as proposed by Blyth. An allied form, with black markings, *L. nitscheri*, has recently been described from Sumatra.

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Family LAGOMYIDÆ.

The animals comprised in this family are of small size, all being considerably smaller than a rabbit. The ears are short and rounded, and there is no external tail. The skull is depressed, orbits elliptical and separated by a narrow frontal area. There are no postorbital processes. A narrow pointed bony lamina extends backwards from the zygomatic arch nearly to the meatus. The clavicles are perfect, the fore and hind limbs short and subequal.

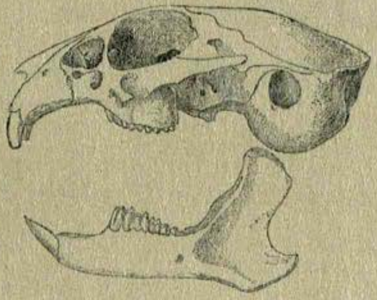

Fig. 148.—Skull of *Lagomys rufescens*, × 1.

Only a single genus is known.

Genus **LAGOMYS**, Cuvier (1798).

Characters of the family. The species are like a guinea-pig in form and inhabit burrows amongst rocks. Some have a peculiar call, on account of which they have been designated piping hares, but this peculiarity does not appear to have been observed in Himalayan species. In many of the forms, perhaps in all, individuals have rufous patches at the side of the neck corresponding apparently to glandular areas. All have the soles of all the feet hairy; the fur is generally thick and soft. The intestines are excessively long in all the species; I found them in *L. rufescens* to be 12 times the length of the head and body.

Dentition: i. $\frac{4}{2}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Vertebræ: C. 7, D. 18, L. 5, S. 2, C. about 10 (in *L. rufescens*).

The genus is chiefly confined to Central and Northern Asia, one species extending into Eastern Europe and one being found in North America. Several kinds inhabit the Himalayas, Tibet, and Afghanistan.

Synopsis of Indian Species.

A. Ears moderate, less than an inch broad.	
a. Toe-pads exposed.	
a′. Colour dark brown or bay, a narrow pale collar or none	*L. roylei*, p. 456.
b′. Colour pale brown, a broad pale collar ..	*L. rufescens*, p. 458.
b. Toe-pads concealed by hair, colour light sandy brown	*L. curzoniæ*, p. 457.
B. Ears more than an inch broad.	
a. Incisive foramen subtrigonal, with sides straight	*L. macrotis*, p. 457.
b. Incisive foramen constricted in middle and with curved sides. Colour brownish yellow	*L. ladacensis*, p. 458.

327. **Lagomys roylei.** *The Himalayan Mouse-Hare.*

Lagomys roylei, *Ogilby, Royle's Ill. Botany &c. Himalaya*, p. lxix, pl. 4 (1839); *Adams, P. Z. S.* 1858, p. 520; *Jerdon, Mam.* p. 226; *Blanf. J. A. S. B.* xli, pt. 2, p. 35; *Büchner, Przewalski, Reis. Mam.* p. 156, pl. xxiii, figs. 1, 2.
Lagomys nipalensis, *Hodgson, J. A. S. B.* x, p. 854, plate at p. 816 (1841).
Lagomys hodgsoni, *Blyth, J. A. S. B.* x, p. 817, plate at p. 844.
Lagomys tibetanus, *A. Milne-Edwards, Rech. Mam.* i, p. 314, pls. xlviii, xlix.

Rang-runt, rang-duni, in Kunawar; *Gúmchen*, Bhutia, Sikhim.

Ears moderate. Toe-pads naked. Incisive foramen subtriangular, with the sides nearly straight.

Colour above brown, varying from greyish brown to rufous brown, sometimes blackish brown, and in many cases bay or deep ferruginous on the neck only or on the head and neck, or throughout the upper surface. Lower parts paler, sometimes whitish. Basal three fourths of fur throughout the body leaden black, terminal fourth of the longer hairs light brown or rufous brown, with, on the upper parts, dark brown or black tips. Ears frequently with a narrow whitish border. Feet pale brown above, soles of hind feet darker brown. There is occasionally a narrow pale collar, but never a broad one as in *L. rufescens*.

Dimensions. Head and body 6·5 inches, tarsus and hind foot from heel to end of claws 1·1; length of ear 0·7, breadth 0·6. Some individuals are rather larger. Zygomatic breadth of skull 0·85.

Distribution. Found throughout the Himalayas from Kashmir to Moupin at elevations between 11,000 and 14,000 feet, or as high as 16,000 in Spiti, according to Stoliczka; also found by Przewalski in the mountains of N.E. Tibet, and of Kansu in China.

Habits. The Himalayan mouse-hare is chiefly found in rocky ground, burrowing and hiding amongst rocks and coarse stones. In the Eastern Himalayas it inhabits pine-forests on steep slopes. It is gregarious, several being found together; it feeds on vegetables near its burrow, and darts into its hole when alarmed. Mr. A. Anderson found four young in a pregnant female; nothing more is known of its breeding-habits.

328. **Lagomys curzoniæ.** *Hodgson's Mouse-Hare.*

Lagomys curzoniæ, *Hodgson, J. A. S. B.* xxvi, p. 207 (1857); *Günther, A. M. N. H.* (4) xvi, p. 230.

Abra, Tibetan.

Ears moderate. Toe-pads hidden by long hair. Incisive foramen as in *L. roylei*, but orbits in the skull smaller and much closer together, nasals shorter and upper surface of skull more convex.

Colour light sandy brown above, nearly white below. Basal half or more of the fur leaden black, terminal portion whity brown, longer dorsal hairs tipped black. Ears with a broad pale border, feet sullied white above and below. Chin dark brown.

Dimensions. Length (of a dried skin) about 8 inches, ear 0·75, tarsus and claws 1·25, zygomatic breadth of skull 0·83.

Distribution. The types were from the Tibetan (but Cis-Himalayan) Chumbi valley east of Sikhim; I have also two specimens procured by Mr. Mandelli's collectors, I believe from very high elevations in Sikhim.

This species is near *L. roylei*, but I think distinct, as the skull appears different.

329. **Lagomys macrotis.** *The large-eared Mouse-Hare.*

Lagomys macrotis, *Günther, A. M. N. H.* (4) xvi, p. 231 (1875); *Blanf. Yark. Miss., Mam.* p. 75; *Scully, P. Z. S.* 1881, p. 207; *id. A. M. N. H.* (5) viii, p. 100 (1881).

Lagomys auritus, *Blanford, J. A. S. B.* xliv, pt. ii, p. 111 (1875); *id. Yark. Miss., Mam.* p. 74, pl. vi, f. 2, pl. vii *a*, f. 2.

Ears large, rounded. Toe-pads exposed. Skull very similar to that of *L. roylei.*

Colour above from pale brownish yellow to smoky or wood-brown, below whitish. Fur leaden black for more than half the length, then sullied white, tips on the upper parts brown, a few with the extreme point black. Feet white. In some animals there is a rufous band across the throat, in others the head, rump, and shoulders are more or less rufous.

Dimensions. Head and body 7·2 inches, length of ear from orifice 1, hind foot from heel with claws 1·35; total length of skull 1·75, breadth across zygomatic arches 0·85.

Distribution. The type came from north of the Kuenlun range on the road from Yárkand to the Karakoram pass. Specimens have since been obtained by Scully and Biddulph in the Gilgit district at from 7500 to 13,000 feet.

The specimens described as *L. auritus* were procured by Dr. Stoliczka at Lukong on the Pangong Lake, Ladak.

Habits. According to Scully, this species frequents open stony ground near the snow-line. It is very locally distributed, but abundant where found.

An allied but distinct form *L. griseus* is found on the Kuenlun range, in the Sanju pass, south of Yárkand. It so closely resembles *L. rutilus* in winter fur, as figured by Büchner, that the two are probably identical. *L. rutilus* inhabits parts of Turkestan and Northern Tibet. Two other species from N. Tibet, *L. erythrotis* and *L. melanostoma*, have just been described by Büchner.

330. **Lagomys rufescens.** *The Afghan Mouse-Hare.*

Lagomys rufescens, *Gray, A. M. N. H.* x, p. 266 (1842); *Hutton, J. A. S. B.* xv, p. 140; *Blyth, Cat.* p. 133; *Blanf. Eastern Persia,* ii, p. 83, pl. vi, fig. 2; *Wood-Mason, P. A. S. B.* 1880, p. 173; *Scully, J. A. S. B.* lvi, pt. 2, p. 75.

Ears moderate. Toe-pads exposed. Fur short. Incisive foramen pyriform.

Colour above light rufescent brown to pale brownish rufescent, below sullied white. Fur leaden black for more than half the length, then brownish white, the points on the back black. A broad whitish collar round the back of the neck, succeeded behind by a dull rufous collar, sometimes sharply limited behind but generally passing gradually into the colour of the back. The rufous collar terminates on each side in a well-marked rufous patch in front of each shoulder. The pale colour is less distinct in the long winter fur and the rufous collar is not seen. Soles of feet whitish.

Dimensions. Head and body of a large male 7·5 inches, ear from meatus 0·8, hind foot from heel to end of claws 1·3; total length of skull 1·9, zygomatic breadth 0·9. Females are a little smaller.

Distribution. Found abundantly on the Bolán pass and the mountains around Quetta and thence northwards in many parts of Afghanistan. This *Lagomys* is also found in Afghan Turkestan, and near Isfahan in Persia. It appears not to occur at less than 5000 or 6000 feet above the sea.

Habits. Like most other species of the genus *L. rufescens* haunts rocky places in communities, dwelling in burrows and fissures and coming out to feed in the morning and evening. It is said to be easily tamed.

331. **Lagomys ladacensis.** *Stoliczka's Mouse-Hare.*

Lagomys curzoniæ, *Stoliczka, J. A. S. B.* xxxiv, pt. 2, p. 108; *Anderson, P. Z. S.* 1871, p. 562, nec *Hodgson.*

Lagomys ladacensis, *Günther, A. M. N. H.* (4) xvi, p. 231 (1875); *Blanford, J. A. S. B.* xliv, p. 110; *id. Yark. Miss., Mam.* p. 71, pls. vi, vii, vii *a.*

Zabra, Karin or *Phise Karin,* Ladák.

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Ears large, rounded. Toe-pads exposed in summer, but nearly concealed by long hairs in winter. Skull very different from those of other Himalayan species. The auditory bullæ are less tumid and differently shaped, and the cranium more convex above. The incisive foramen is constricted about halfway between the incisors and premolars, and almost divided into a small anterior elongate elliptical orifice and a large posterior pyriform space between the premolars.

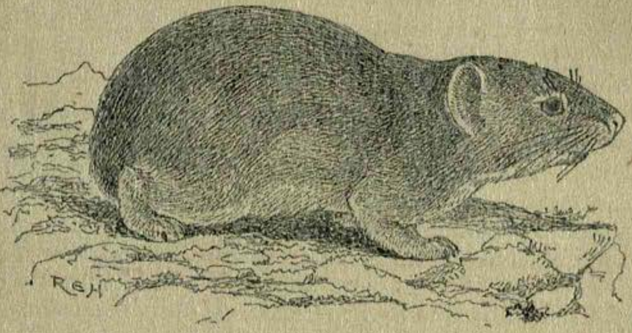

Fig. 149.—*Lagomys ladacensis.*

Colour above pale rufescent fawn with a greyish tinge varying to rufous, below pale buff or whitish. In worn summer fur, the face and back are distinctly rufous and the dark basal portion of the hair shows. Basal half of fur or more than half leaden black throughout the body, distal portion fulvous, tips on the back dark brown or black. Face and outside of ears generally more rufous than the back. Whiskers mixed black and white. Soles of feet pale-coloured. Young animals light-coloured.

Dimensions. Head and body 9 inches, ear from orifice 1·1, hind foot and nails 1·5; total length of skull 2·25, zygomatic breadth 1·25. These measurements are those of a large old individual.

Distribution. Eastern Ladak and Rukshu at great elevations between 14,500 and 19,000 feet.

Nothing particular has been recorded of the habits. The skull of this species differs from those of all other Himalayan and Afghan forms in the peculiarly shaped incisive foramen, which resembles those of *L.* (*Ogotona*) *dauricus* and *L. alpinus*. *L. rufescens*, however, is somewhat intermediate in this character between *L. ladacensis* and its allies on the one hand, and *L. roylei*, *L. curzoniæ*, &c. on the other.

Many other species of *Lagomys* inhabit Central and Northern Asia.

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Order UNGULATA.

The great order of hoofed quadrupeds, to which belong horses, rhinoceroses and tapirs, sheep, oxen, goats and antelopes, deer, pigs, hippopotami, and their allies, together with a vast number of extinct animals, is by most modern naturalists extended to include the elephants and hyraces, whilst by other systematists these animals are distinguished as separate orders called *Proboscidea* and *Hyracoidea*. The first view is here accepted. The order Ungulata, thus defined, includes the Pachydermata and Ruminantia of Cuvier.

In general organization the Ungulates are much higher than Insectivores, Bats, and Rodents, and are but little inferior to Carnivores. All the living forms are terrestrial in their habits (except *Hippopotamus*), and all feed mainly or exclusively on vegetables.

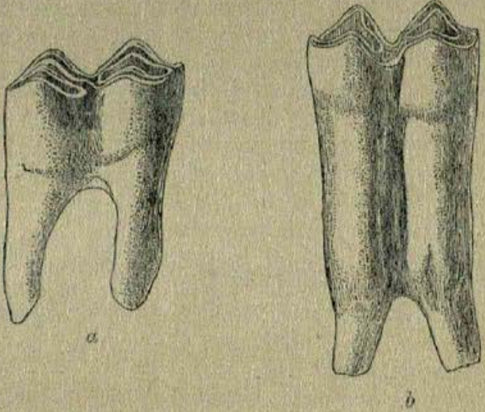

Fig. 150.—A. Brachydont lower molar of deer (*Cervus elaphus*), × 1.
B. Hypsodont lower molar of ox (*Bos taurus*), × ⅔.

In all, the limbs are adapted for progression and not for prehension. All are heterodont and diphyodont, and their molars have broad crowns with tuberculated or ridged surfaces. The toes, except in *Hyrax* and the *Camelidæ*, terminate in hoofs which enclose the ungual phalanges more or less completely; in a few forms the toes are connected together by the integuments, but as a rule they are free. The digits of each foot vary in number from five to one. Clavicles are wanting.

Ungulates are bunodont, when the crown of the unworn molars is tubercular, as in pigs; or selenodont, when it is composed of one

GSL

or more crescents, as in deer and oxen. They are termed hypsodont when the crown of each tooth is long and the root short, and brachydont when the reverse is the case, as shown in the accompanying figure. The brachydont is the normal or original form, and the great lengthening of the crown in horses, oxen, &c., appears to be the result of specialization. Rootless teeth with persistent pulps, like the incisors of rodents, elephants, and hippopotami, are a more advanced stage of the same specializing process. Hypsodont molars in a rodent have already been noticed in the case of *Eupetaurus* (p. 359).

The present order contains four existing suborders, of which three are Indian. They are thus distinguished :—

A. *Os magnum* of carpus articulating with lunar or cuneiform, not with scaphoid. (*Subungulata.*)	
a. Size very large; a long flexible proboscis; toes 5—5	PROBOSCIDEA.
b. Size small; no proboscis; toes 4 (5)—3. Resembling rodents	HYRACOIDEA.
B. *Os magnum* articulating with scaphoid (figs. 151, 157, pp. 468, 480); toes never exceeding 4 in number. (*Ungulata vera.*)	
a. Third or middle digit of all feet largest	PERISSODACTYLA.
b. The two median digits (3rd and 4th) equal	ARTIODACTYLA.

The *Hyracoidea* (*Hyrax* or *Procavia*) are only found in Africa, Syria, and Arabia.

In preparing the following account of the Indian Ungulates, I have been able to make use of the important new work on "Mammals, living and extinct," by Flower and Lydekker, and of W. L. Sclater's new 'Catalogue of Mammalia in the Indian Museum'; whilst for details of habits and occasionally of coloration and measurement, especially those of Himalayan and Tibetan species, I have taken much from Kinloch's 'Large Game Shooting.' Sterndale's 'Mammalia of India and Ceylon' has also been of much service in the present as in other orders.

The Indian extinct Ungulata are so numerous that it is impossible to notice all in this work. Full details will be found in the 'Palæontologia Indica,' Series x. (Lydekker), and in Falconer's 'Fauna Antiqua Sivalensis' and 'Palæontological Memoirs.' A general list, with notes, by Lydekker has been printed in the Records of the Geological Survey of India for 1887, pp. 51–79. Earlier lists by the same writer appeared in 1880 (J. A. S. B. xlix, pt. 2, p. 8) and 1883 (Rec. G. S. I. xvi, p. 87).

GSL

SUBUNGULATA.

Suborder *PROBOSCIDEA.*

Nose produced into a long flexible proboscis, with the nostrils at the end, and serving as a prehensile organ. Incisors forming conical tusks, often of large size in male animals, never exceeding one pair in each jaw and confined to the upper jaw in living forms. No canines. Molars large, more or less elongate, with flat parallel sides and transversely ridged. Limbs stout; radius distinct from ulna and tibia from fibula. Feet massive, each with 5 toes, the outer more or less rudimentary. Stomach simple. A capacious cæcum. Testes permanently abdominal. Uterus bicornuate. Placenta non-deciduate, zonary. Mammæ two, pectoral. Brain of low type, the cerebellum being entirely behind the cerebrum and uncovered by it.

The Proboscideans, although highly specialized, are of lower grade than other Ungulates. By many naturalists elephants and their allies are regarded as having affinities with Rodents.

A single family containing but one living genus. Of extinct forms a large number are found in later Tertiary beds, and from the Upper Miocene, Pliocene, and Pleistocene of India no fewer than 7 species of *Elephas* are known, besides 8 of the allied genus *Mastodon* and 2 of *Dinotherium.*

Family ELEPHANTIDÆ.

Genus **ELEPHAS**, Linn. (1766).

Dentition: i. $\frac{2}{0}$, c. $\frac{0}{0}$, m. $\frac{6-6}{6-6}$. The incisors (tusks) are preceded by milk-teeth, shed at an early age, and have enamel only on the tips before these are worn away, the remainder of each tusk consisting of solid dentine. The molars come into use successively from the back of the jaw, and are worn away and shed in front, not more than one, or portions of two, on each side of each jaw being in wear at once; the three anterior, which come first into use, being regarded as milk-molars not succeeded by premolars, whilst the last three are true molars. All are composed of enamel-covered plates or ridges of dentine with cement between. The number of transverse ridges increases from the first to the last molar.

Skull large, high, and globular, the greater portion consisting of cancellous tissue containing air-cells which communicate with the nasal passages. The brain is small, and lies far back between the

GSL

ear-orifices, or rather a little below them and in front of them. Nasal bones short and placed above the narial opening in the skull, which opening is high on the face. Malar small, forming only the middle part of the zygomatic arch, the anterior portion of which is a process of the maxillary, quite unlike the arrangement in true Ungulates. Vertebræ: C. 7, D. 19–21, L. 3–4, S. 4, C. 26–33.

In the limbs the upper or proximal segment (humerus or femur) greatly exceeds in length the distal segment (manus or pes). The ankle-joint or heel in the hind leg, corresponding to the hock of other Ungulates, is very little raised above the ground. Pelvis and scapula nearly vertical. Feet short and broad, the fore foot nearly circular, the hind foot smaller, longitudinally oval.

Elephants are purely herbivorous. There are two living species, one peculiar to Africa, and distinguished by a differently shaped head, larger ears, much fewer and differently shaped ridges on the molar teeth, and other characters, and one found in India.

332. **Elephas maximus.** *The Indian Elephant.*

Elephas maximus, *L. Syst. Nat.* i, p. 48 (1766), partim.
Elephas indicus, *Cuv. Règne An.* i, p. 231 (1817); *Kelaart, Prod.* p. 77; *Blyth, Cat.* p. 134; *Falconer, Nat. Hist. Review*, 1863, pp. 81, &c.; *Jerdon, Mam.* p. 229; *W. Sclater, Cat.* p. 206.
Elephas sumatranus, *Temm. Coup d'œil Poss. Néer.* ii, p. 91 (1847); *Schlegel, Amsterdam, Verslag. Akad.* xii, p. 101 (1861); *id. Nat. Hist. Review*, 1862, p. 72.

Hathi (fem. *Hathni*), H.; *Hasti, Gája*, Sansc.; *Fil*, Pers.; *Haust*, Kashmiri; *Gáj*, Beng.; *Ane*, Tel., Tam., Can., Mal.; *Yáni*, Gond; *Hattanga, Khondha Eniga*, Tel; *Yanei, Kunjaram, Veranum*, Mal.; *Ata, Allia*, Cing.; *Tengmú*, Lepcha; *Lángchen, Lámboché*, Bhotia; *Mongma, Naplo*, Gáro; *Miyung*, Cachári; *Atche*, Aka; *Sotso, Supo, Chu, Tsu*, Nága; *Sitte*, Abor; *Tsang*, Khámtí; *Magui*, Singhpho; *Saipi*, Kuki; *Amieng, Mányong*, Mishmi; *Sámú*, Manipuri; *Tsheng*, Burm.; *Tsing*, Talain; *Tsan*, Shan; *Káhsa*, Karen; *Gája*, Malay.

Skin nearly naked. Tail with a row of long coarse hairs for a few inches before and behind and round the end only. Five hoofs normally on each fore foot, four hoofs on each hind foot. The number of ridges in each molar from the first to the last is 4, 8, 12, 12, 16, and 24, with slight variation. Males as a rule have well developed tusks; some males, known in India as *makna*, have merely short tusks like females.

Colour blackish grey throughout. The forehead, base of the trunk, and the ears often mottled with flesh-colour. White elephants are albinoes.

Dimensions. The vertical height at the shoulder in adult elephants is almost exactly twice the circumference of the fore foot. Adult males do not as a rule exceed 9 feet, females 8 in height, but a male has been measured by Sanderson as much as 10 feet 7½ in.; Col. Hamilton says that Sir V. Brooke killed one of 11 feet; and a

GSL

skeleton *, now in the Indian Museum, Calcutta, measures 11 feet 3 in., so the animal when living, if the skeleton is correctly mounted, must have been nearly 12 feet high. Kelaart records having seen a Ceylon elephant of the same dimensions. A male 9 ft. 7 in. high measured 26 ft. 2½ in. from tip of trunk to end of tail. Weight of a male 8 feet high, 57 cwt.; of a female 7 ft. 6 in. high, 51 cwt. (P. Z. S. 1881, p. 450). The last two animals were not full-grown. Tusks vary greatly, the longest recorded I believe (Sir V. Brooke's, from Mysore) measured 8 ft. and weighed 90 lbs., but a shorter tusk from Gorakhpur is said to have weighed 100 lbs. Both were from elephants with but one tusk perfect. Two pairs from the Gáro hills are said to have weighed 157 and 155 lbs. respectively ('Asian,' October 16th, 1888, p. 35).

Distribution. The forest-clad portions of India, Ceylon, Assam, Burma, Siam, Cochin China, the Malay Peninsula, Sumatra, and Borneo, perhaps introduced in the last named. In India elephants are still found wild along the base of the Himalayas as far west as Dehra Dún; also in places in the great forest country between the Ganges and Kistna as far west as Biláspur and Mandla, in the Western Ghats as far north as 17° or 18°, and in some of the forest-clad ranges in Mysore and farther south. They do not appear to ascend the Himalayas to any elevation, but are sometimes found at considerable heights above the sea in Southern India, and in Ceylon they wander at times near Newera Ellia to over 7000 feet. Formerly the range of the elephant in India was greater; it was found wild about A.D. 1600 in Malwa and Nimar (Ain-i-Akbari, Gladwin's translation, ii, pp. 45 & 63), and at a much more recent date in Chánda, Central Provinces.

Habits. The following summary is chiefly taken from the admirable description by Sanderson in 'Thirteen years among the Wild Beasts of India,' chapters vi, viii, &c. Sir Emerson Tennent's account of the Ceylon elephants, though often quoted, is not, like Sanderson's, the result of personal observation, and is less accurate.

The country chiefly inhabited by elephants is tree-forest, undulating or hilly, generally containing bamboos in considerable quantities, but the animals often enter the high grass growing on alluvial flats. Individuals of various sizes and ages, and of both sexes, associate in herds, usually numbering 30 to 50, but not uncommonly more, sometimes 100. These herds often break up temporarily into smaller groups. The males are frequently found alone, but as a rule each belongs to a herd and joins it occasionally.

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* The animal, I believe, when alive was the tusker of a small herd that for many years haunted the country north of the Rániganj coal-field, from Soory and the southern spurs of the Rájmehal hills to Jamtára. Though I never came across them I often heard of them, and saw their old tracks between 1856 and 1860. Some fossil Indian elephants, for instance *E. ganesa* and *E. namadicus*, probably surpassed all living elephants in stature.

Since the above was written, I have been told by Mr. Sanderson that he compared the femur of the Calcutta skeleton with that of an elephant known to have been less than 10 feet high, and only found one-eighth inch difference in length.

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All members of a herd generally belong to the same family, and are nearly related: different herds do not mix, but stray females or young males appear to obtain admission to a herd without difficulty. The leader of a herd is invariably a female. According to Sanderson a really solitary elephant is rare, many "rogue" elephants that have become notorious belonging to a herd.

The food of elephants consists principally of various kinds of grass, leaves and shoots of bamboos, wild plantains (*Musa*), of which both stems and leaves are eaten, and leaves, small branches, and bark of particular trees, especially of species of *Ficus*. Sanderson found by experiment that a full-grown elephant consumes between 600 and 700 lb. of green fodder per diem. Elephants drink twice a day in general, before sunset and after sunrise. Both food and drink are conveyed to the mouth by the trunk; tufts of grass or branches of trees are plucked by coiling the end of the trunk round them; leaves are stripped from boughs, and even bark from trees or branches, in a similar manner; only very small objects, such as small fruits, are picked up between the lobes above and below the nostrils at the tip of the trunk. In drinking, the end of the trunk is immersed and the lower part (in Sanderson's opinion not more than 15 or 18 inches) filled by suction with water, which is then discharged into the mouth. Grain such as rice is eaten in a similar way, being drawn into the end of the trunk and then blown into the mouth.

In the wild state elephants roam about and feed for the greater part of the day and night, resting from about 9 or 10 A.M. till about 3 P.M. and again from about 11 P.M. to 3 A.M. They lie down to sleep like other mammals. Whilst feeding the herds scatter somewhat, but they quickly collect when alarmed. In many places elephants migrate considerable distances at particular seasons, chiefly in search of fodder, but partly it is believed to avoid insects, and generally from higher to lower ground or *vice versâ*, or from one kind of forest to another. In marching, they keep in strict Indian file. They are fond of bathing and of rolling in mud in warm weather. They squirt water on their bodies with their trunks when heated, and when water is not at hand they draw some, by means not clearly understood, from the mouth or throat. The fluid thus obtained is probably a secretion, perhaps salivary. They sometimes, especially when exposed to the sun, throw dust or leaves over their backs.

The sense of smell is highly developed, but neither sight nor hearing is particularly acute.

The only pace of elephants is a walk, slow or quick, at times increased to a shuffling run. They are incapable of any motion resembling a gallop, or of the least jump, vertical or horizontal. A 7-foot trench is impassable by them, though a large elephant can clear 6½ feet in its stride. They climb very steep places, bending the fore legs when ascending and the hind legs when descending, and kicking or pressing holes for the feet if necessary (J. A. S. B. xiii, p. 917, pl. ii). In kneeling down an elephant first bends the hind legs one after the other, then the fore legs, which are stretched out in front; in rising the process is reversed.

Few animals not aquatic by nature swim as well as elephants. They have been known to swim for six hours or even more without resting. The pace is not rapid, probably about a mile an hour.

The principal sounds made by elephants are the following. First the shrill trumpet, varying in tone, and expressive, sometimes of fear, sometimes of anger. Secondly a roar from the throat, caused by fear or pain. A peculiar hoarse rumbling in the throat may express anger or want, as when a calf is calling for its mother. Pleasure is indicated by a continued low squeaking through the trunk. Lastly, there is a peculiar metallic sound made by rapping the end of the trunk on the ground and blowing through it at the same time. This indicates alarm or dislike, and is the well known indication of a tiger's presence. An elephant sometimes tries to frighten its enemies by blowing through its trunk.

Most elephants are timid inoffensive animals, though individuals are vicious; females with young offspring and solitary males or "rogues" being most disposed to attack. The attack is made with the trunk tightly coiled, the feet, and in males the tusks, being used for purposes of offence, and the adversary, if caught, is generally trampled upon.

I quite agree with Sanderson in believing that the intelligence of elephants has been greatly overrated. They are singularly docile and obedient—no other mammal is known to be capable of domestication when adult to nearly the same extent—and docility in animals is generally I think confounded with intelligence *. Judging by the development of its brain, an elephant is probably of lower intellectual capacity than other Ungulates.

Tame elephants very rarely breed in India. In parts of Burma and Siam breeding from tame females is said to be common. The period of gestation has been ascertained to be about 19 months (Heysham, P. Z. S. 1865, p. 731, and 1880, p. 23), though it is said to vary from 18 to 22; and according to some writers (*e. g.* Campbell, P. Z. S. 1869, p. 139) the latter period has been recorded (see also P. Z. S. 1880, p. 222, and J. Ac. Sc. Philad. (2) viii, p. 413). The young are generally born in September, October, and November, though a few are produced at other seasons. Twins are a rare exception, a single young one the rule. The young when born is about 3 feet high and weighs about 200 lb. It sucks with the mouth, not with the trunk, which is short and but little flexible. An elephant is full grown, but not fully mature, at 25 years of age, and individuals have been known to live over 100 years in captivity; in a wild state their existence probably extends to 150 years.

Male elephants are liable to periodical attacks of excitement, supposed to be of a sexual nature, though this does not appear clearly proved. During such attacks the animals are said to be "mast," and are often dangerous to men or to other elephants. The attack is preceded and accompanied by the flow of an oily secretion from a small orifice in each temple. Sanderson says he has seen the same secretion in newly caught female elephants. A somewhat similar phenomenon occurs amongst camels.

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* 'Geology and Zoology of Abyssinia,' p. 225, note.

Much has been written on the capture and hunting of elephants. Wild herds are usually driven into stockades or *Kheddahs*, enclosures made of trunks of trees. The animals are then secured, and removed one by one by the aid of tame elephants. Another mode of capture, especially of large males, is to follow them on females and to tie their hind legs when they are asleep. Some wild individuals are run down by fast tame elephants, and the neck or legs noosed.

UNGULATA VERA.

The true Ungulates form a very well-marked group, and all living forms are higher in organization than the Subungulates. They agree in the following characters :—The toes never exceed four in any foot; the first digit is always wanting. The malar or jugal bone in all living forms is in contact with the lachrymal, and is not confined to the zygomatic arch, but forms part of the wall of the skull. The *os magnum* of the carpus articulates with the scaphoid. The testes descend into a scrotum. The uterus is bicornuate, the placenta non-deciduate, and the chorionic villi either evenly diffused or collected in groups or cotyledons. The mammæ are usually inguinal and never exclusively pectoral. Cerebral hemispheres well convoluted and covering part of the cerebellum.

Suborder *PERISSODACTYLA.*

This suborder is poorly represented at the present day—horses, rhinoceroses, and tapirs being the only surviving members of a group of animals that was extensively developed in the earlier Tertiary periods.

Perissodactyle Ungulates are characterized by the third or middle digit being much more developed than the others, and by its having the two sides similar. The number of digits in each foot is, as a rule, odd, and in living forms either one or three, except in tapirs, which have four toes on each fore foot. The femur bears a "third trochanter," a flattened and curved process from the outer side of the bone near the proximal end; the dorsal and lumbar vertebræ together are 22 to 24 in number; the nasal bones are expanded posteriorly, and there is an alisphenoid canal. The premolar and molar teeth in existing genera are similar and form a continuous series; the crown of the last lower molar is bilobed. The stomach is simple, the cæcum large, the placenta diffused, and the mammæ inguinal.

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The three existing genera of this suborder constitute distinct subdivisions of considerably higher rank than ordinary families.

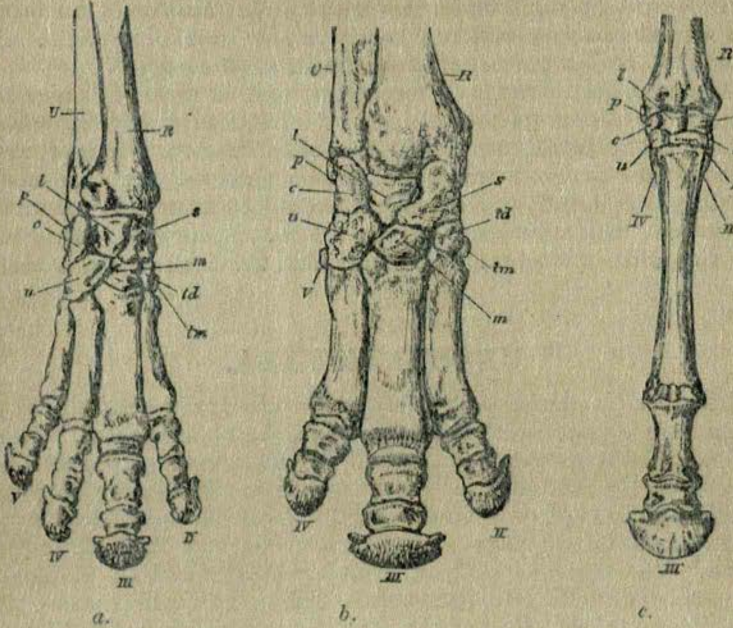

Fig. 151.—Bones of the manus of:—*a.* Horse (*Equus caballus*), *b.* Rhinoceros (*Rhinoceros sumatrensis*), *c.* Tapir (*Tapirus indicus*). II, III, IV, V, second, third, fourth, and fifth digits. *U*, ulna; *R*, radius; *c*, cuneiform; *l*, lunar; *s*, scaphoid; *u*, unciform; *m*, magnum; *td*, trapezoid; *tm*, trapezium. (From Flower's 'Osteology of Mammalia.')

They may, however, for simplicity be classed as of family rank, and living forms may be distinguished thus:—

Only one digit developed in each foot	**Equidæ.**
Three digits on each foot; one or two horns on the nose	**Rhinocerotidæ.**
Four digits on fore feet, three on hind; no horns	**Tapiridæ.**

Family EQUIDÆ.

Genus **EQUUS**, Linn. (1766).

The characters of the family may, for convenience, be included in the description of the only living genus. In this each foot is formed of a single digit consisting of a metacarpal or metatarsal and three phalanges, the distal phalanx being surrounded by a broad hoof. This single digit is the third (not, as was formerly thought by some naturalists, two toes united), the rudimentary metatarsals and metacarpals of the second and fourth digits forming the splint bones, one on each side *. The ulna and fibula are rudimentary and incomplete distally.

The general form is graceful, and the limbs are adapted for great speed. The head is elongate, there is a crest or mane of longer hairs along the back of the neck, and there are long hairs on the tail. Inside each forearm in all living species, and also inside each tarsus in the horse (*E. caballus*) only, is a peculiar callosity, the use of which is not known. There are two inguinal mammæ.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$. Canines generally wanting in females. There is sometimes an additional small anterior upper premolar. The incisors have a flat crown, with at first a deep hollow in the middle; this (the "mark" in horses) disappears with age. The premolars and molars have flat rectangular crowns with extremely complicated folds of enamel, and are of the hypsodont type, having elongate crowns and short roots. Vertebræ: C. 7, D. 18, L. 6, S. 5, C. 15–18.

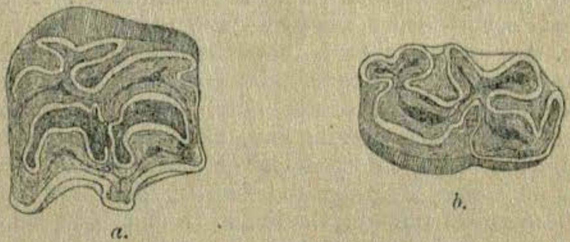

Fig. 152.—Crowns of (*a*) upper and (*b*) lower second right true molars of *Equus hemionus*, the inner side uppermost.

This genus contains the horses, asses, and zebras, now restricted, in the originally wild state, to Asia and Africa, though wild horses, descended from tame animals, abound in parts of America. One species occurs on the north and west frontiers of India.

In late Tertiary times the genus had a far wider range, and remains of several species are found in Indian deposits. Two forms, one indistinguishable from *E. asinus*, the other closely resembling *E. hemionus*, are represented in the Karnul Caves (Pleistocene); a larger kind, *E. namadicus*, in the Pleistocene Nerbudda beds; and two species of *Equus*, besides four of the 3-toed *Hipparion*, in the Pliocene Siwaliks.

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* In several extinct genera of *Equidæ* other digits were developed, and a gradual passage from a four-toed form to the present greatly specialized single-toed type has been traced.

GSL

333. **Equus hemionus.** *The Asiatic Wild Ass.*

Equus hemionus, *Pallas, Nov. Com. Acad. Petrop.* xix, p. 394, pl. vii (1775); *Sykes, P. Z. S.* 1837, p. 91; *Walker, J. A. S. B.* xvii, pt. 2, p. 1, pl. i; *Thomason, P. Z. S.* 1848, p. 62; *Blyth, J. A. S. B.* xxvi, p. 239, note, xxviii, p. 229; *Strachey, J. A. S. B.* xxix, p. 136; *Blyth, Cat.* p. 136; *George, Ann. Sc. Nat.* xii, p. 23 (1869); *W. Blanf. Eastern Persia*, ii, p. 84; *Aitchison, Tr. L. S.* (2) v, p. 61; *W. Sclater, Cat.* p. 198.
Equus kiang, *Moorcroft, Travels*, i, p. 312 (1841); *Hay, P. Z. S.* 1859, p. 353, pl. lxxiii.
Asinus equioides, *Hodgson, J. A. S. B.* xi, p. 287 (1842).
Asinus polyodon, *Hodgson, Calc. Jour. N. H.* vii, p. 469, pl. vi (1847); viii, p. 98.
Asinus onager *and* A. hemionus, *Gray, Cat. Ung. Furc. B. M.* pp. 269, 272 (1852).
Equus onager, *Blyth, J. A. S. B.* xxviii, p. 229; *id. Cat.* p. 135; *Jerdon, Mam.* p. 236.
Equus hemippus, *Is. Geoffr. St. H. Compt. Rend.* xli, p. 1214 (1855).
Asinus indicus, *Sclater, P. Z. S.* 1862, p. 163.

Ghor-khar, P. & H.; *Ghur*, *Ghurán*, Baluch; *Kiang*, Tibetan.

Ears rather large. Tail covered with short hair near the base, growing gradually longer to the end. Mane erect. A naked callosity inside each forearm, none on the hind legs.

Colour. A dark brown stripe, sometimes with a whitish margin, along the back from nape to tail, and continued down part of the latter, the anterior part of the stripe formed by the mane; remainder of upper parts varying from rufescent grey (isabelline) to fawn colour or pale chestnut, lower parts white. Occasionally there is a dark cross stripe on the shoulder, and faint rufous bars are said to occur at times on the limbs. End of tail blackish. Tips of ears and hair close to hoof darker.

Dimensions. Height at shoulder 3 feet 8 inches to 4 feet. An adult female, that I shot on the Punjab and Sind frontier in 1882, measured: height 3 ft. 10 in., length from nose to rump over curves of back 6 ft. 11 in., length of tail (including hair) 2 ft. 2 in., ear from crown 9. A male skull from Tibet measures in basal length 17·5 inches, zygomatic breadth 7·8.

Distribution. Found throughout a large area in Central and Western Asia. Common in Ladak and throughout Tibet, north of the main Himalayan range. A few occur in Baluchistan, especially west of the Indus near Mithankot, on the Punjab frontier. Some are found east of the Indus, in Bickaneer, Jeysulmere, and on the Rann of Cutch.

Varieties. There are three forms of the Asiatic wild ass that have been classed as distinct species:—*E. hemionus* (the *Kiang*) of Tibet and Mongolia, *E. onager* v. *indicus* (the *Ghorkhar*) of Western India and Baluchistan, and *E. hemippus* of Persia and Syria. The last two by all accounts differ but little, but the *Kiang* is in general darker and redder than the *Ghorkhar* and has a narrower dorsal stripe. In the *Ghorkhar* this stripe is broader and narrowly

MINISTRY OF CULTURE · GOVERNMENT OF INDIA
CSL

bordered with whitish or white. Other alleged differences, such as greater size in the *Kiang*, and the presence of a cross shoulder-stripe in the *Ghorkhar*, are not borne out by specimens I have examined. I agree with Sykes, Blyth, Strachey, George, and Flower in classing all these wild asses as one species.

Habits. The Asiatic wild ass inhabits desert or semi-desert plains, and is usually found in herds varying in number from 4 or 5 to 30 or 40 individuals; occasionally much larger numbers collect; Dr. Aitchison, in North-western Afghanistan, saw a herd that he estimated to contain 1000 animals. This was in April, and the large herds are said to consist of mares and foals.

The food consists of various grasses, green or dry, and of other plants. The voice of this animal has been described as a shrieking bray. Wild asses are renowned for speed, but in the Rann of Cutch adults have been run down by men on horseback and speared. I believe, however, the animals run down were mares in foal. The young are captured by using relays of horsemen to hunt them until tired out.

In the country west of the Indus the mares are said to drop their foals in June, July, or August. The period of gestation is probably the same as in the horse and ass, about 11 months.

Family RHINOCEROTIDÆ.

Genus **RHINOCEROS**, Linn. (1766).

In this family also all living species are by most naturalists referred to a single genus. There are three toes on each foot, each toe terminating in a small hoof-like nail. The size is large, the general form is heavy, and the legs are short and stout. The skin in all living forms is thinly clad with hair or is naked, and in all Indian species it is thick (so much so, that it was formerly supposed to be bullet-proof) and thrown into deep folds in places. One or two dermal horns are situated on the median line above the snout. These horns grow throughout the animal's life, and if lost are reproduced. The head is large, the eyes small, and the ears moderate. There are two inguinal mammæ.

The skull is elongate, with a high occipital crest. The nasal bones are large and united, broad behind, and in contact or nearly in contact with the large lachrymals; they are arched in front and project over a wide space that separates them from the premaxillaries. There are no postorbital processes, the orbits opening into the temporal fossæ. Tympanics small, not forming bullæ.

Dentition: i. $\frac{2(4)}{2(4)}$, c. $\frac{0}{0}$, pm. $\frac{4-4}{4-4}$, m. $\frac{3-3}{3-3}$. The incisors are somewhat variable: all are deciduous in African species; in adults of the Asiatic forms there are generally one pair, broad and blunt, in the upper jaw, and one or two pairs in the lower, the outer pointed and formidable weapons; according to some these are lower canines. The anterior premolar in both jaws is very often wanting. The other upper premolars and molars are subquadrate with a longitudinal crest along the outer side and peculiarly incurved ridges on the inner; lower molars and premolars narrower, each formed of two crescentic ridges. The patterns on the teeth after wear are shown by the accompanying figure. Vertebræ: C. 7, D. 19–20, L. 3, S. 4, C. about 22. Ulna and fibula well developed and distinct.

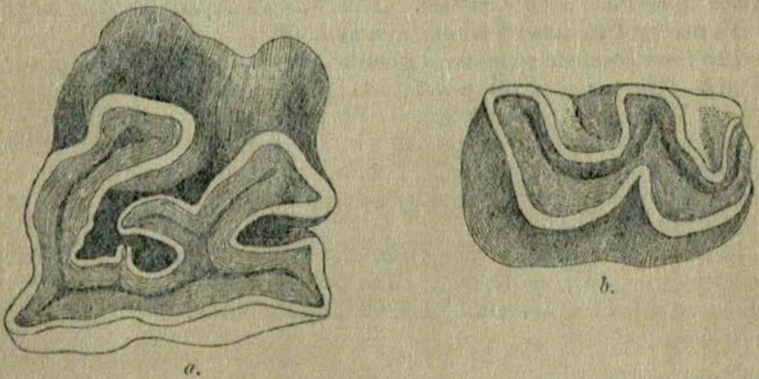

Fig. 153.—Crowns of (*a*) upper and (*b*) lower second right true molars of *Rhinoceros unicornis*, the inner side uppermost.

The genus is only found living in Africa and South-eastern Asia. Formerly it was widely distributed. Three extinct species, besides *R. unicornis*, have been recorded from the Pleistocene, and five from the Pliocene and Miocene beds of India.

Synopsis of Indian and Burmese Species.

A. A single horn on the nose.	
a. Fold in front of shoulder not continued over back of neck; skin of sides bearing tubercles	*R. unicornis*, p. 472.
b. Fold in front of shoulder continued over back of neck; skin of sides divided into small polygonal scales	*R. sondaicus*, p. 474.
B. Two horns on nose	*R. sumatrensis*, p. 476.

334. **Rhinoceros unicornis.** *The great one-horned Rhinoceros.*

Rhinoceros unicornis, *L. Syst. Nat.* i, p. 104 (1766); *Hodgson, P. Z. S.* 1834, p. 98; *Gray, P. Z. S.* 1867, p. 1010; *Sclater, P. Z. S.* 1871, p. 8; *id. Tr. Z. S.* ix, p. 645, pl. xcv; *Flower, P. Z. S.* 1876, p. 454; *W. Sclater, Cat.* p. 202.

Rhinoceros indicus, *Cuv. Règne An.* i, p. 239 (1817); *Blyth, J. A. S. B.* xxxi, pp. 151, 199; *id. Cat.* p. 136; *Jerdon, Mam.* p. 232; *Lydekker, J. A. S. B.* xlix, pt. 2, p. 135; *Cockburn, J. A. S. B.* lii, p. 56.

Rhinoceros stenocephalus, *Gray, P. Z. S.* 1867, p. 1018.

Guinda, Gargadan, H.; *Karkadan*, P.; *Gonda*, Beng.

GSL

Skin naked except on the tail and ears, and on the sides studded with convex tubercles, half an inch to an inch or rather more in diameter, the largest on the buttocks and thighs and on the shoulders. Skin of body divided into great shields by folds before and behind each shoulder, and before each thigh; the folds behind the shoulders and before the thighs continuous across the back, those in front of the shoulders not joined across the back but turning backwards and lost above the shoulder. There are also great folds round the neck, others below the shoulders and thigh-shields and behind the buttocks, so that the tail lies in a groove. Epidermis on limbs forming small polygonal scales. The head is higher and altogether larger than in other Asiatic species. Incisors generally $\frac{2}{4}$; inner lower incisors small, outer large, pointed. Skull very high, mesopterygoid fossa narrow; hinder margin of bony palate simply concave. Horn well developed in both sexes.

Colour blackish grey throughout.

Dimensions. Height at shoulder 5 feet to 5 feet 9 inches. A large male measured: height 5 ft. 9 in., length from nose to root of tail 10 ft. 6 in., tail 2 ft. 5 in., girth 9 ft. 8 in. (*Kinloch*). Length of horn rarely exceeding a foot. Basal length of a skull 23 inches, zygomatic breadth 15·3.

Distribution. At the present day the great Indian rhinoceros is almost restricted to the Assam plain, and it is very rare, if it exists, west of the Teesta river. Twenty to thirty years ago it was still common in the Sikhim Terai, and not many years previously it was found along the base of the Himalayas in Nepal and as far west as Rohilcund. Up to about 1850, or rather later, some rhinoceroses inhabited the grass-jungles on the Ganges at the north end of the Rájmehal hills, and were, I think, probably *R. unicornis*. Formerly this animal was extensively distributed in the Indian Peninsula. It was common in the Punjab as far west as Pesháwar in the time of the Emperor Baber (1505–1530). Semifossilized remains of it have been found in the Bánda district, North-west Provinces, and near Madras; and its co-existence with several mammals now extinct, the Indian hippopotamus for one, is shown by its occurrence in the Pleistocene beds of the Nerbudda Valley.

Habits. The great Indian rhinoceros is a denizen of the grass-jungles, tracts of grass from 8 to 20 feet high, that cover so much of the uncultivated portions of the North-Indian alluvial plains. It appears never to ascend the hills; it has a distinct preference for swampy ground, and is fond of rolling in mud. Though each animal is solitary as a rule, several are often found in the same patch of jungle.

Despite its bulk and strength, this rhinoceros is as a rule a quiet inoffensive animal, the stories of its ferocity and of its deadly enmity to the elephant, that were copied from the not very veracious pages of Captain Williamson's 'Oriental Field Sports' into European works on natural history, being fables. A rhinoceros when wounded or driven about will, however, sometimes charge home, though this is an exception. When it does attack, this species uses its sharp lower incisors (or, as some think, lower canines) much as a hog does. I was shown in Cooch Behar a straight horizontal scar on the leg of one of the Maharaja's elephants just above the foot. This I was assured on good authority was the mark of a wound inflicted by a rhinoceros, and it is manifest such a wound could not have been produced by the horn (see also Blyth, J. A. S. B. xi, p. 891).

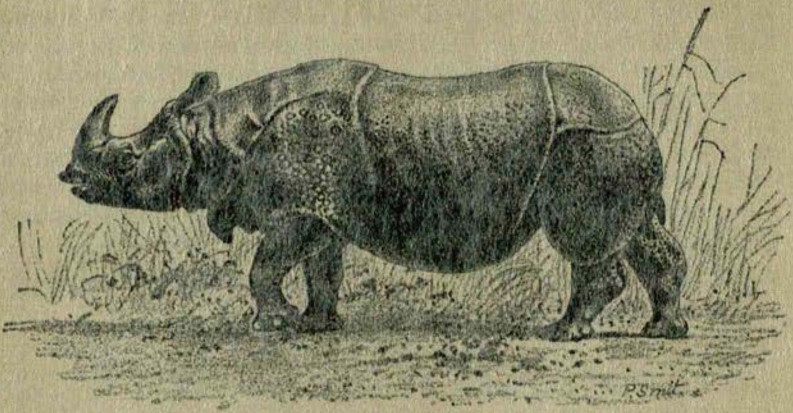

Fig. 154.—*Rhinoceros unicornis.*

The only sound known to be produced by the present animal is a peculiar grunt that it repeats frequently when excited. It is said by several writers to have a habit of depositing its dung in the same spot until a pile accumulates. The African *R. bicornis* has, I believe, no such habit.

Like other Ungulata, rhinoceroses can trot and gallop as well as walk. They as a rule sleep during the day and feed in the morning and evening. Their food consists, I believe, chiefly of grass. Their flesh is excellent, as I can testify. This rhinoceros is a long-lived animal and, according to Hodgson, is believed to live 100 years. I have heard of individuals that had existed 50 or 60 years in confinement. The period of gestation is said by Hodgson to be 17 or 18 months, by Desmarest under 9 months, a single young one being produced.

335. **Rhinoceros sondaicus.** *The smaller one-horned Rhinoceros.*

Rhinoceros sondaicus, *Cuv.*, *Desm. Mam.* p. 399 (1822); *Blyth*, *J. A. S. B.* xxxi, p. 151; *id. Cat.* p. 137; *id. Mam. Birds Burma*, p. 50; *Jerdon*, *Mam.* p. 234; *Sclater*, *P. Z. S.* 1874, p. 182, pl. xxviii; *id. Tr. Z. S.* ix, p. 649, pl. xcvi; *Fraser*, *J. A. S. B.* xliv, pt. 2, p. 10, pl. v; *Flower*, *P. Z. S.* 1876, p. 454; *Ball*, *P. A. S. B.* 1877, p. 170; *Cockburn*, *P. A. S. B.* 1884, p. 140; *W. Sclater*, *Cat.* p. 202.

Rhinoceros javanicus, *Cuv. Hist. Nat. Mam.* livr. 45, pl. 309 (1824); *Rainey*, *P. A. S. B.* 1878, p. 139.

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Rhinoceros inermis, *Lesson, Complêments du Buffon*, ed. 2, i. p. 514 (1848); *Peters, MB. Akad. Berl.* 1877, p. 68, pls. i–iii.
Rhinoceros nasalis *and* R. floweri, *Gray, P. Z. S.* 1867, pp. 1012, 1015.

Gainda, H.; *Gondu*, Beng.; *Kunda, Kedi, Kweda*, Nága; *Kyeng, Kyantsheng*, Burmese; *Bádák*, Malay.

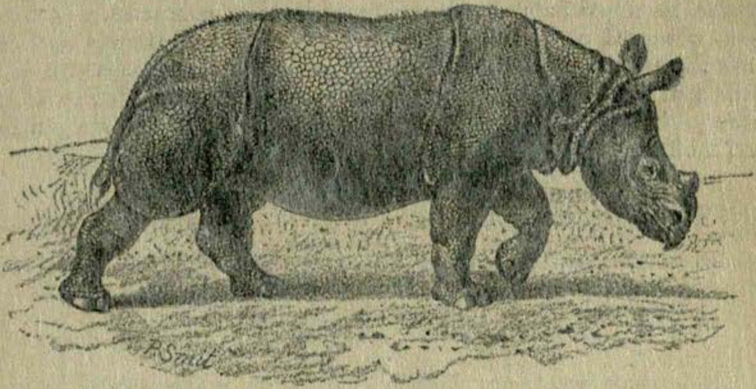

Fig. 155.—*Rhinoceros sondaicus.*

Animal altogether smaller, though scarcely, if at all, lower at the shoulder than *R. unicornis*; head much smaller. Skin naked or nearly so, not tubercular, the epidermis divided by cracks into small, polygonal, subequal scale-like disks throughout the body and limbs. Surface of body divided into shields by folds, as in *R. unicornis*, but the fold in front of the shoulders is continuous across the back like that behind the shoulders and that in front of the thighs. Neck-folds comparatively little developed. Incisors generally $\frac{2}{1}$; upper molars smaller and with a simpler pattern than those of *R. unicornis*; skull and mandible of less height, mesopterygoid fossa broad. Hinder margin of bony palate produced in the middle; a partially ossified septum narium. The horn is frequently, perhaps always, wanting in the female.

Colour dusky grey throughout.

Dimensions. Rather less than those of *R. unicornis*, but most of the measurements published appear to be those either of young animals or of individuals in confinement, which very often do not attain their full growth. A large female, according to Mr. Fraser and Mr. Cockburn, was 5 feet 6 inches high. A skull measures 23 inches in basal length, 13·8 in zygomatic breadth.

Distribution. The Sundarbans and parts of Eastern Bengal; Kinloch shot an undoubted specimen in the Sikhim Terai. From Assam this rhinoceros is found throughout Burma and the Malay Peninsula, and in Sumatra, Java, and Borneo. Blyth states that this species was formerly found near Rajmehal, but does not give any reason for the identification. The statement, mentioned by

Jerdon, that a few individuals existed in the forests of Orissa, has been ascertained by Mr. Ball and myself to be a mistake. So far as I am aware, there is no evidence at present that this rhinoceros ever inhabited the Peninsula of India. Its remains have, however, been found fossil in Borneo (P. Z. S. 1869, p. 409).

Habits. R. sondaicus is more an inhabitant of tree-forest than of grass, and although it is found in the alluvial swamps of the Sundarbans, its usual habitat appears to be in hilly countries. It has been observed at considerable elevations both in Burma and in Java; and the tracks seen by Major Macgregor south-east of Sadiya, at 7000 feet above the sea (Proc. R. Geog. Soc. 1887, p. 27), were probably made by this species. It is said to be more gentle and inoffensive than *R. unicornis*.

336. **Rhinoceros sumatrensis.** *The Asiatic two-horned Rhinoceros.*

Rhinoceros sumatrensis, *Cuv. Règne An.* i, p. 240 (1817); *Sclater, P. Z. S.* 1872, p. 790, pl. lxvii; *id. Tr. Z. S.* ix, p. 650, pl. xcvii; *Anderson, P. Z. S.* 1872, p. 129; *Bartlett, P. Z. S.* 1873, p. 104, pl. xi; *Beddard & Treves, P. Z. S.* 1889, p. 7; *W. Sclater, Cat.* p. 204.
Rhinoceros sumatranus, *Raffles, Tr. L. S.* xiii, p. 268 (1820); *Blyth, J. A. S. B.* xxxi, p. 151; *id. Cat.* p. 137.
Rhinoceros crossei, *Gray, P. Z. S.* 1854, p. 251; *Blyth, P. Z. S.* 1861, p. 307; *id. J. A. S. B.* xxxi, p. 156.
Rhinoceros lasiotis, *Sclater, P. Z. S.* 1872, p. 493, pl. xxiii; *id. Tr. Z. S.* ix, p. 652, pl. xcviii; *Flower, P. Z. S.* 1878, p. 634; *W. Sclater, Cat.* p. 204.
Ceratorhinus crossei *and* C. sumatrensis, *Blyth, A. M. N. H.* (4) x, p. 399 (1872); *id. Mam. Birds Burma*, pp. 51, 52.
Ceratorhinus sumatranus, C. niger, C. crossei, *and* C. blythii, *Gray, A. M. N. H.* (4) xi, pp. 357–360, pl. xi (1873); *id. Hand-list Edent. &c. Mam. B. M.* pp. 47–50.
Ceratorhinus sumatrensis *and* C. lasiotis, *Flower, P. Z. S.* 1876, p. 455.

Kyan, Kyan-shaw, Burmese; *Bádák*, Malay.

This is the smallest of living rhinoceroses and the most hairy, the greater part of the body being thinly clad with hair of some length, and there being hair of considerable though varying length on the ears and tail. The two horns are some distance apart at the base; both are slender above, and the anterior horn, in fine specimens, elongate and curved backwards. The skin is usually rough and granular; the folds, though much less marked than in the one-horned species, are still existent, but only that behind the shoulders is continued across the back. Incisors in adults $\frac{2}{2}$, the lower pair lateral, large, and pointed; sometimes lost in old animals.

Colour varying from earthy-brown to almost black; hair of body brown or black.

Dimensions. Somewhat variable. The type of *R. lasiotis* was 4 ft. 4 in. high at the shoulder, and 8 feet long from snout to root of tail; its weight about 2000 lbs. (*Anderson*). An old female from Malacca was only 3 ft. 8 in. high. The average height of adults is probably

4 feet to 4 feet 6 in. The largest known specimen of the anterior horn measures 32 inches over the curve. Skull 20 inches in basal length, 11·25 in zygomatic breadth.

Varieties. Specimens from Chittagong and Malacca were living at the same time in the Zoological Society's Gardens, London, in 1872; and the former was distinguished by Sclater as *R. lasiotis* on account of its larger size, paler and browner colour, smoother skin, longer, finer, and more rufescent hair, shorter and more tufted tail, by the ears having a fringe of long hair but being naked inside, and above all by the much greater breadth of the head. Unquestionably the differences are considerable; but by far the most remarkable—the shape of the head—was shown by Blyth to be variable in both *R. unicornis* and *R. sondaicus*, for he figured and described a broad and a narrow type of each (J. A. S. B. xxxi, p. 156, pls. i–iv) as well as of *R. sumatrensis.* The other distinctions scarcely appear to me of specific value, and I am inclined to regard the two forms as varieties only.

Distribution. Rare in Assam, though one specimen has been recorded on the Sankosh river, in the Bhutan Duars (P. Z. S. 1875, p. 566). Another was shot 20 miles south of Comillah in Tipperah in February 1876 (P. Z. S. 1877, p. 269). From Assam the species ranges to Siam, the Malay Peninsula, Sumatra, and Borneo.

Habits. Very similar to those of the other species; this rhinoceros inhabits forests and ascends hills to a considerable elevation, having been observed 4000 feet above the sea in Tenasserim by Tickell. This is a shy and timid animal, but easily tamed even when adult.

Details obtained by Mr. Bartlett concerning a young animal born in London, induced him to regard the period of gestation as probably a little over 7 months (P. Z. S. 1873, p. 104). This differs greatly from Hodgson's account of the period in *R. unicornis* (P. Z. S. 1834, p. 98), but no details are furnished in the case of the last-named species, whilst the evidence is stated in that of *R. sumatrensis.* Still, for so large and apparently so long-lived an animal, 7 months of uterine life is short.

Anderson, in his 'Fauna of Mergui and its Archipelago,' i, p. 333, mentions his having heard of a two-horned rhinoceros seen swimming in the sea, near High Island in the Archipelago. Probably all rhinoceroses are good swimmers. The story of the Chittagong rhinoceros that was unable to swim (P. Z. S. 1872, p. 494) must be, I think, a mistake. The account given by Mason and repeated by Blyth, of this or any rhinoceros attacking fire, should be received with great caution. To my personal knowledge, Mr. Blyth's principal informant had a weakness for relating "shikar stories," which were frequently good, but not always authentic.

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Family TAPIRIDÆ.

Genus **TAPIRUS**, Brisson (1766).

The last and least specialized family of surviving Perissodactyle Ungulates again consists of a single genus, having four toes on each fore, and three on each hind foot. The general form is heavy, the limbs short and stout, the tail short, the ears oval, the eyes small, and the nose and upper lip produced into a snout or short proboscis.

The skull is compressed laterally and is rather high. There are no true postorbital processes. The anterior opening of the nares is very large; the nasals are short, triangular, pointed in front, and widely separated from the premaxillaries.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{3-3}$, m. $\frac{3-3}{3-3}$. The outer upper incisors are large and conical, larger than the canines. Molars and premolars bilophodont, having the crowns mainly composed of two transverse ridges.

Vertebræ: C. 7, D. 18, L. 5, S. 6, C. about 12. The ulna and fibula distinct and complete.

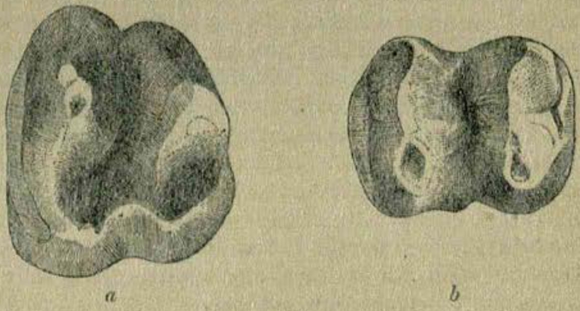

Fig. 156.—Crowns of (*a*) upper and (*b*) lower second right true molars of *Tapirus indicus*, the inner side uppermost.

One species, the largest of the genus, is Malayan and occurs in Tenasserim. All other living forms are Central- or South-American. Remains of several extinct species have been discovered in Europe, of one in China, and of one rather doubtful form in Burma.

337. **Tapirus indicus.** *The Malay Tapir.*

Tapirus indicus, *Cuv.*, *Desmarest*, *Nouv. Dict. d'Hist. Nat.* xxxii, p. 458 (1819); *W. Sclater*, *Cat.* p. 198.

Tapirus malayanus, *Raffles*, *Tr. L. S.* xiii, p. 270 (1822); *Cantor*, *J. A. S. B.* xv, p. 263; *Blyth*, *Cat.* p. 135; *id. Mam. Birds Burma*, p. 49.

Tapirus bicolor, *Wagner*, *Schreb. Säugth.* vi, p. 400 (1835).

Tara-shu, Burmese; *Kuda Ayer*, *Tennu*, Malay.

GSL

Colour. The body behind the shoulders, including the rump and upper part of the thighs, white or greyish white, tips of the ears the same; head, limbs, and fore part of body black or dark brown.

The young at first are velvety black or brownish black, with spots and longitudinal streaks of brownish yellow on the sides and of white below. This coloration changes into that of the adult between 4 and 6 months after birth.

Dimensions. Height at shoulder 3 ft. to 3 ft. 6 in., at rump 4 inches higher; length from nose to tail, over curves, 8 feet. A skull measures 15·75 inches in basal length by 8 in zygomatic breadth.

Distribution. The Malay Peninsula, extending north in Tenasserim as far as about N. lat. 15°; also Sumatra.

Habits. The Malay tapir is a shy, mild, and gentle creature, inhabiting the wilder forests, and, it is said, avoiding inhabited tracts. It is nevertheless, when captured, easily tamed. It is fond of water, and is said to plunge in and walk along the bottom, instead of swimming.

Suborder *ARTIODACTYLA.*

By far the majority of living Ungulates belong to this suborder, which comprises all the Ruminants together with the hippopotami and pigs.

The digits are even in number, either 2 or 4 on all feet, and the 3rd and 4th digits are subequal. No third trochanter on the femur. Dorsal and lumbar vertebræ together always 19. No alisphenoid canal. Nasal bones not expanded behind. Premolar and molar teeth usually dissimilar, the former with a single lobe, the latter bilobed or trilobed. Last lower molar, with very few exceptions, trilobed. Stomach almost always more or less complex. Cæcum small. Placenta diffused or cotyledonary. Mammæ inguinal or abdominal.

A. No upper incisors. Ruminant.	
a. Horns generally present in males, sometimes in females; second and fifth digits incomplete, the metapodials rudimentary or absent.	**PECORA.**
a′. Horns permanent, a corneous sheath on a bony core	**Bovidæ.**
b′. Horns permanent, covered with hairy skin; lateral digits wanting	**Giraffidæ** (Africa).
c′. Horns branched, deciduous, but on unbranched bony cores	**Antilocapridæ** (America).
d′. Horns solid, deciduous, generally branched, no cores	**Cervidæ.**
b. No horns; second and fifth digits complete..	**TRAGULINA.** **Tragulidæ.**

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Upper incisors present.
- a. Selenodont. Ruminant.................. **TYLOPODA.**
  Lateral digits wanting .... **Camelidæ.**
- b. Bunodont. Non-ruminant .... **SUINA.**
  - a′. Snout elongate, with a terminal flat disk containing nostrils; feet narrow, outer digits not reaching ground.
    - a″. Toes 4—3 .... **Dicotylidæ** (America).
    - b″. Toes 4—4 .... **Suidæ.**
  - b′. Snout broad, hairy, no terminal disk; feet short, broad, outer digits reaching ground **Hippopotamidæ** (Africa).

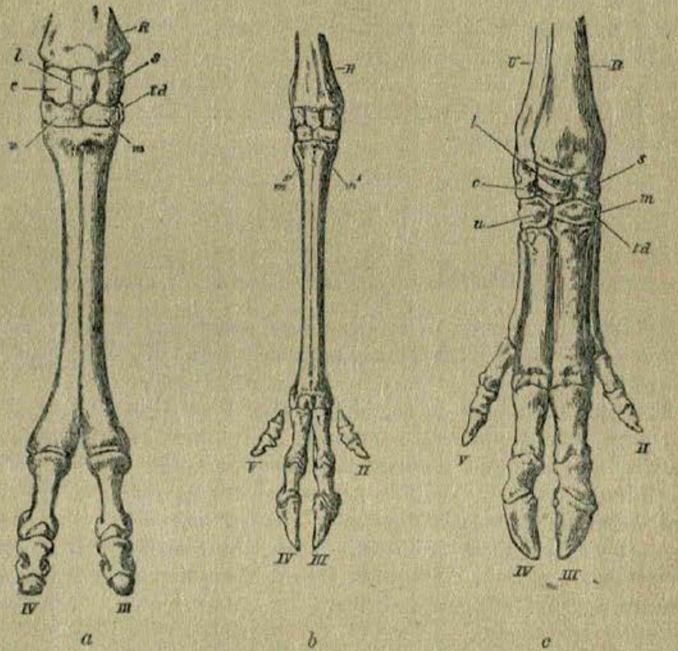

Fig. 157.—Bones of the right fore foot in:—*a*. Camel (*Camelus bactrianus*), *b*. Red Deer (*Cervus elaphus*), *c*. Pig (*Sus scrofa*).—*U*, ulna; *R*, radius; II, III, IV, V, second, third, fourth, and fifth digits; *c*, cuneiform; *l*, lunar; *s*, scaphoid; *u*, unciform; *m*, magnum; *td*, trapezoid; m^2, m^5, rudimentary second and fifth metacarpals. (Flower's 'Osteology of the Mammalia.')

There are a few terms used in describing the genera and species of Artiodactyle Ungulates that require explanation.

The *muffle* or *rhinarium* is the naked moist area between and around the nostrils.

The *suborbital glands* are situated in front of the eye, and each has a circular or longitudinal orifice termed by some "eye-pit." Generally, when the gland is present, there is a corresponding hollow, sometimes of large size, in the surface of the skull, on the inner anterior side of the orbit. This depression is the *lachrymal fossa*.

The *inguinal glands* are in the hollow of the groin.

The *interdigital glands* are between the large third and fourth digits, the orifice, or "foot-pit," of each being in front between the free portions of the digits.

The *lachrymal fissure* is a vacuity in the bones of the face forming the outer wall of the skull between the lachrymal and nasal.

The maximum lengths of horns in *Bovidæ* and *Cervidæ* are chiefly from some MS. notes kindly lent to me by Mr. A. O. Hume; from the same notes I have taken details as to localities, native names, &c. I have also made use of a list of maximum measurements of horns published by Mr. W. L. Sclater in the 'Asian' of 1891, pp. 197, 217, and 232, and republished in pamphlet form; and of some notes for which I am indebted to Colonel J. Biddulph and Mr. R. A. Sterndale.

PECORA.

The typical Ruminants are distinguished by several well-marked characters, of which the following are the most important. There are no premaxillary teeth. The dental formula is almost invariably i. $\frac{0}{6}$, c. $\frac{0}{1-1}$ or $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$; the lower canines precisely resembling the incisors and in contact with them. The molars are selenodont, that is they have crescent-shaped tubercles on the unworn crown and show crescentic patterns after wear. Third and fourth metapodials (metatarsals and metacarpals) confluent, forming "cannon-bones." Outer or lateral toes small or sometimes wanting; their metapodial bones never complete. Navicular and cuboid bones of tarsus united. Horns or antlers generally present, at least in the male sex. Stomach with four complete cavities. Placenta cotyledonous.

The stomach of the Pecora is more complicated than that of the other Ruminants, the camels and chevrotains, and comprises four well-defined cavities, whereas in the Tylopoda and Tragulina there are only three. The four cavities are known as:—(1) The rumen or paunch, much the largest, which has its mucous lining membrane closely covered with villi, resembling the pile on velvet; (2) the reticulum or honeycomb-bag, with the lining membrane arranged in shallow hexagonal cells; (3) the psalterium or manyplies, the inner surface of which is composed of numerous longitudinal folds; and (4) the abomasum or reed, which is the digestive stomach proper. The food when swallowed is received in the paunch, and after being retained there for a time, and undergoing a softening process, it is regurgitated into the mouth, where it undergoes the process known as "chewing the cud" and consisting of trituration by the molar teeth.

GSL

Family BOVIDÆ.

Horns permanent (non-deciduous), in the majority of the genera present in both sexes, and each composed of a bony core, containing numerous air-cells, encased in a horny sheath. No upper canines. Molars frequently hypsodont. The lateral digits always imperfect, sometimes entirely absent, but generally they are either represented by the hoofs alone, or by the hoofs with a very rudimentary skeleton, the phalanges replaced by irregular nodules of bone. The distal ends of the lateral metapodials wanting. A gall-bladder almost always present. Placenta with numerous cotyledons.

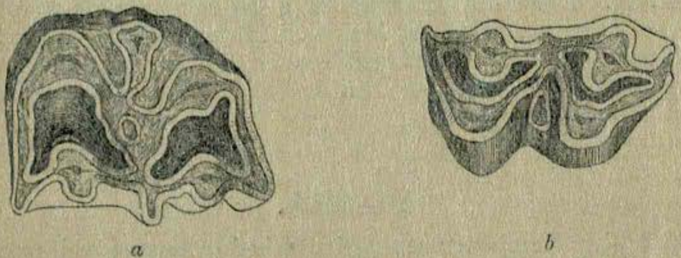

Fig. 158.—Crowns of (*a*) upper and (*b*) lower second right molars of *Bos gaurus*, the inner side uppermost.

The *Bovidæ*, or hollow-horned Ruminants (*Cavicornia*), are a very extensive family, containing all cattle, goats, sheep, and true antelopes, and they are distributed throughout Europe, Asia, Africa, and North America. The following genera occur within Indian limits :—

A. Horns smooth, or closely, irregularly, and transversely wrinkled.
  a. Horns in both sexes, not differing much in size ; inserted far apart, at extremities of vertex. Size of animal large .... BOS.
  b. Horns in both sexes, inserted near together.
    a'. Horns large in males, small in females.
      a''. Males inodorous : horns curved at sides of head .... OVIS.
      b''. Males odorous : horns ascending, spiral or scimitar-shaped .... CAPRA.
    b'. Horns small (not longer than head) in both sexes and not differing much in size.
      a''. Males odorous : horns angulate in front .. HEMITRAGUS.
      b''. Males inodorous : horns not angulate.
        a³. Suborbital glands present .... NEMORHÆDUS.
        b³. No suborbital glands.................. CEMAS.
  c. Horns in males only, not so long as head.
    a'. Size large : male with 2 horns ; a long tail .. BOSELAPHUS.

  b′. Size small: generally 4 horns in male; tail short .... TETRACERUS.
B. Horns with prominent rings at subequal intervals.
  a′. Horns much longer than head; females hornless.
    a″. Horns spiral; muzzle fine .... ANTILOPE.
    b″. Horns nearly straight; muzzle swollen.... PANTHOLOPS.
  b′. Horns scarcely longer than the head; females sometimes with horns.................... GAZELLA.

Genus BOS, Linn. (1766).

Syn. *Bubalus* and *Bison*, H. Smith (1827); *Bibos*, Hodgs. (1837); *Poëphagus*, Gray (1843); *Gavæus* and *Syncerus*, Hodgson (1847).

Size large. Body massive and limbs stout. Tail long, usually tufted at the end. Muffle naked, large and broad. No suborbital, inguinal, or interdigital glands. Mammæ 4.

Horns in both sexes, not differing greatly in size, smooth or nearly so; inserted, far apart, on each extremity of the vertex of the skull, spreading more or less outwards at first, then curving upwards. The surface of the skull behind the horns makes an angle rather less than a right angle with the face. Molars very hypsodont. Vertebræ: C. 7, D. 13–14, L. 6–5, S. 5, C. 15–18.

By many modern writers the animals here referred to the genus *Bos* have been distributed amongst several genera. The distinctions between the latter, however, are scarcely of generic rank. The principal subdivisions are the typical or taurine, comprising *Bos gaurus* and *B. sondaicus*, the bisontine, including *B. grunniens*, and the bubaline, to which *B. bubalus* belongs.

Indian fossil oxen are numerous, at least 3 Pleistocene and 10 Pliocene forms having been described. The most important are the Pleistocene *B. namadicus*, somewhat allied to *Bos gaurus*, but with much larger horns, ancestral forms of the gaur and buffalo, and a Pliocene bison, *B. sivalensis*.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Horns round or oval in section.
  a. No fringe of long hair on sides; a raised dorsal ridge.
    a′. No white on back of thighs.
      a″. Horns turned inwards near the tips .. *B. gaurus*, p. 484.
      b″. Horns spreading, not turning inwards . *B. frontalis*, p. 487.
    b′. A large white disk on back of thighs .... *B. sondaicus*, p. 489.
  b. A fringe of long hair on sides; no dorsal ridge .... *B. grunniens*, p. 490.
B. Horns trigonal or subtrigonal .... *B. bubalus*, p. 491.

The common domestic humped cattle of India, *Bos indicus*, belong to a species differing in structure, general coloration, voice, and habits from the tame animal of Europe and Northern Asia, *B. taurus*. The origin of *B. indicus* (sometimes called Zebu by European naturalists) is unknown, but was in all probability tropical or subtropical, and was regarded by Blyth as probably African. No ancestral form has been discovered amongst Indian fossil bovines, which, as already mentioned, comprise species allied to the gaur and buffalo. Humped cattle have run wild at times in many parts of India (Oudh, Rohilcund, Surat, Mysore, Nellore, Char Sidhi, at the mouth of the Megna, &c.: see Blyth, J. A. S. B. xxix, p. 288, and Jerdon, Mam. p. 301).

338. **Bos gaurus.** *The Gaur.*

Gour, *Trail, Edinb. Phil. Jour.* xi, p. 334 (1824).
Bos gaurus, *Ham. Smith, Griffith's Cuv. An. Kingd.* iv, p. 399 (1827); *Evans, J. A. S. B.* vi, p. 223, pl. xvi; *Elliot, J. A. S. B.* x, p. 579; *Blyth, J. A. S. B.* xi, p. 444, xxi, p. 433, xxxi, p. 336; *id. Mam. Birds Burma*, p. 47; *W. Blanf. P. Z. S.* 1890, p. 592, pl. xlix; *W. Sclater, Cat.* p. 124.
Bos gour *and* B. gayæus, *Hardwicke, Zool. Jour.* iii, p. 233 (1828).
Bibos subhemachalus, *Hodgson, J. A. S. B.* vi, p. 499 (1837).
Bibos cavifrons, *Hodgson, J. A. S. B.* vi, p. 747 (1837), x, p. 449, pl. xvi, p. 706; *Blyth, J. A. S. B.* xi, p. 588; *Elliot, Mad. Jour. L. S.* x, p. 227; *Horsfield, Cat.* p. 181.
Bos gour, *Cantor, J. A. S. B.* xv, p. 272.
Bibos asseel, *Horsfield, Cat.* p. 181 (1851).
Gavæus gaurus, *Blyth, J. A. S. B.* xxix, p. 282; *id. Cat.* p. 161; *Jerdon, Mam.* p. 301.

Gaur, *Gauri-gai*, H.; *Gáyál*, in Orissa, &c.; *Gaor* ♂, *Gaib* ♀, in Chutia Nágpur (commonly *Ban-boda*, *Ban-parra*, *Ran-hila*, *Ran-pado*, *Jangli-khulga*, and even *Ban-bhainsa* and *Arna*, all signifying wild buffalo, in various parts of the Peninsula); *Sainal*, Hokol; *Gaviya*, Mahr.; *Pera-Mao*, Gond. in the South; *Katu-erimai*, Tam.; *Karkona*, *Karti*, *Kard-yemmé*, *Kard-korna*, *Doddu*, Can.; *Karthu*, *Paothu*, Mal.; *Mithan*, Assam; *Seloi*, Chittagong; *Pyoung*, Burmese; *Saladang*, Malay. The *Bison* or *Indian Bison* of European sportsmen.

General form massive; body deep, limbs and hoofs small. Ears large. A high ridge along the anterior half of the back terminating abruptly about halfway between the shoulder and the tail, and caused by the spinous processes of the dorsal vertebræ being long and those of the lumbar vertebræ short, the change in length taking place suddenly. Skull bearing a high ridge, convex on the vertex between the horn-cores; in front of this ridge the forehead is deeply concave. Horns considerably flattened towards the base, curved throughout; the tips turned inwards and slightly backwards. Thirteen pairs of ribs. Tail just reaching the hocks. No distinct dewlap. Hair short, very thin on the back in old bulls.

Skulls from the Duars of Bhutan, the Mishmi hills, and the Malay Peninsula are much broader in proportion across the forehead than those from the Indian Peninsula; but I cannot say whether the broad-headed type is alone found east of the Bay of Bengal. I think not. There is in the fine collection presented by Mr. Hume to the British Museum a very broad skull from Salem, South India. The only Mishmi skull I have seen, one in Mr. Hume's collection, has the vertex arched and the forehead broad, but wants the frontal concavity, and thus shows a tendency towards *B. frontalis.* The horns in all these heads have the normal curve of the gaur (see fig. 159, p. 488).

Colour. Brown, almost black in old males, less dark and sometimes more rufous in females and young males, especially during the cold season, and in those inhabiting drier parts of the country, where there is less shade. Lower parts rather paler, hair about axil and groin golden brown. Legs from above the knees and hocks to the hoofs white. Head from above the eyes to the nape ashy grey, becoming in some animals whity-brown or dirty white. Muzzle pale-coloured. In calves, according to Blyth, there is a dark stripe down the back. Horns pale greenish or yellowish, with black tips.

Dimensions. This appears to be the largest of existing bovines. Large bulls are said to exceed 6 feet in height at the shoulder, but this is rare and exceptional, 5 ft. 8 in. to 5 ft. 10 in. being the usual height. Cows are much smaller, about 5 ft. high. A huge bull measured by Elliot was 6 ft. 1½ in. high, 9 ft. 6 in. from nose to root of tail, tail 2 ft. 10 in. long, girth behind shoulders 8 ft. A cow 4 ft. 10½ in. high measured 7 feet from nose to rump over curves, and 6 ft. 9 in. in girth. A large male skull from the Western Ghats measures 18 inches in basal length and 9·9 in zygomatic breadth. Average male horns measure 20 to 24 inches round the outside curve. Horns from Travancore have been recorded 39 inches in length and 19 inches in girth at the base; whilst other Travancore horns measure 20·75 in girth, and a pair from the Malay Peninsula 22, though only 32 long. Large cows' horns measure 23 and 24 round the outside curve, with a girth of 13·25. The girth of each horn in freshly killed specimens is about an inch more than in dried skulls.

Distribution. All the great hilly forest-tracts of the Indian Peninsula, Assam, Burma, and the Malay Peninsula. The eastern range of this species is not clearly known except that it is said to extend to Siam and, I believe, to Cochin China. *B. gaurus* does not exist in Ceylon nor in any of the Malay Islands; it is said, however, to have inhabited Ceylon up to the commencement of the present century*. In India at present its extreme north-western habitat is probably the Rajpipla hills, near Broach; and west of long. 80° East the river Nerbudda forms approximately, though

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* Knox, writing in 1681, mentioned under the name of *Guavera* an animal kept tame at Kandy. The description of this animal corresponds with *B. gaurus.* Kelaart (Prod. p. 87), Forbes ('Journal of Eleven Years' Residence in Ceylon,' ii, p. 159), and Griffiths (Cuv. An. King. v, p. 410) also mention the Guavera or Goura as formerly inhabiting Ceylon. On the other hand, Sanderson has pointed out the improbability of the gaur having disappeared from an area where wild elephants still exist in large numbers. Nevill ('Taprobanian,' iii, p. 5) regards it as probable that the gaur formerly existed wild in Ceylon, but had been introduced by man.

GSL

not absolutely, the northern boundary of its range. It does not inhabit the grass-jungles of the Gangetic plain, except close to the Himalayas; but it is found in the forests at the foot of those mountains as far west as Nepal. South of the Ganges it exists in suitable tracts in Chutia Nágpur, Orissa, and the northern Circars, the Central Provinces, Hyderabad territories, Mysore, and throughout the Western Gháts, wherever it has not been exterminated or driven away.

Habits. Excellent accounts are given by Elliot (*l. c.*), Forsyth ('Highlands of Central India'), Sterndale (Nat. Hist. Indian Mam. and 'Seonee'), Hornaday ('Two Years in the Jungle'), J. D. Inverarity (Jour. Bombay N. H. Soc. iv, p. 294), and above all by Sanderson ('Thirteen Years &c.'). Hodgson's description is evidently from native reports and is untrustworthy; whilst Col. Campbell's delightful stories in 'The Old Forest Ranger,' though quoted with approval by many writers, must, I fear, be regarded as works of imagination.

The gaur keeps to forest or high grass, generally but not always near hills, and is found in herds of from five or six to about 20, or occasionally more. Bulls often wander by themselves, and the finest and oldest bulls are said always to occur solitary; still very large bulls are found with herds, and young bulls are frequently seen alone, or two or three together. All are shy and avoid cultivated tracts as a rule, though instances occur in wild parts of the country of gaur feeding on growing crops. Their food consists chiefly of grasses; they do not commonly browse, though they occasionally eat the leaves and even the bark of particular trees, and they are fond of the shoots of bamboos. They feed generally in the early morning and evening, and lie down to rest from about 9 A.M. to about 4 P.M., and at night. They drink as a rule in the afternoon.

These bovines inhabit the hills of the Indian Peninsula to an elevation of 5000 or 6000 feet, or occasionally even higher; but they do not ascend the Himalayas to nearly the same extent. They are admirable climbers, and ascend or descend steep hills with wonderful facility. They are timid animals, but in wild places, where they are rarely subject to attack and disturbance, they are by no means remarkably wary. Wounded animals occasionally charge, and solitary bulls have been known to attack without provocation; but the tales of the gaur's ferocity recorded by some sportsmen are not confirmed by any of the later writers who have had good opportunities of studying the animals. A bull gaur is one of the noblest animals in the world, a model of strength and symmetry, and his formidable appearance has led to his being unjustly credited with a savage disposition.

The period of gestation is not known with any certainty. Breeding is said to take place in the cold season. The calves are mostly born (in the Peninsula of India) in August or September, a few early in April, May, or June. Gaur suffer from the same diseases as domestic cattle.

In India all attempts at domestication of this bovine have been failures. The calves appear always to die in captivity, none it is said having been known to attain their third year. But there can be little doubt that the gaur has been tamed and kept tame in some of the hill-tracts between Assam and Burma (see also under *B. frontalis* on the next page); and quite recently a young male animal, now nearly four years old, has been brought to England from Pahang, in the Malay Peninsula, and is still (1891) living in the Zoological Gardens, Regent's Park.

According to Sanderson, three distinct sounds are uttered by this species. The first is a sonorous bellow, used as a call, and unlike any of the usual bovine sounds. The second is a low "moo," indicative of apprehension or curiosity. The third is the well-known whistling snort of alarm with which the animal dashes off when frightened. I have heard the tame animal in the Regent's Park utter a prolonged call, not very unlike the lowing of *Bos taurus*, but utterly unlike that of *B. indicus*.

339. **Bos frontalis.** *The Gayal or Mithan.*

Bos frontalis, *Lambert, Tr. L. S.* vii, pp. 57, 302, pl. iv (1804); *Griffith, J. A. S. B.* viii, pp. 211, 281; *Blyth, J. A. S. B.* xxxi, p. 338; *id. Mam. Birds Burma*, p. 48; *Sclater, P. Z. S.* 1866, p. 1, pl. i; *J. Sarbo, P. Z. S.* 1883, p. 142; *W. Blanf. P. Z. S.* 1890, p. 593, fig. 2; *W. Sclater, Cat.* p. 126.

Bos gavæus, *Colebrooke, As. Res.* viii, p. 488, pl. (1805); *Hodgson, J. A. S. B.* x, pp. 453, 470, pl.

Bos sylhetanus, *F. Cuvier, Hist. Nat. Mam.* pls. 418, 419 (1824).

Gavæus frontalis, *Hodgson, J. A. S. B.* xvi, p. 705; *Horsfield, Cat.* p. 179; *Blyth, J. A. S. B.* xxix, p. 291; *id. Cat.* p. 162.

Gáyál, H.; *Mithan, Bunerea-goru, Gavi* or *Gabi*, Assam and Chittagong; *Sandung*, Manipuri; *Shel, Shio*, Kuki; *Jhongnua*, Mugh; *Bui-sang, Hui*, Naga; *Phu*, Aka; *Siba*, Daphla; *Nuni, Tsaing*, Burmese.

Very similar to *B. gaurus* but smaller, with proportionally shorter limbs, somewhat less developed dorsal ridge, a well-marked dewlap, and very different skull and horns, as shown in the accompanying figures (p. 488). The head is shorter, with shorter nasals, the forehead quite flat, and the transverse outline of the vertex between the horn-cores straight, not arched. The horns are much less curved, in fact nearly straight, spreading outwards and directed more or less upwards at the tips, but not inwards.

Colour very similar to that of *B. gaurus*. Head and body dark brown in both sexes, legs from above the knees and hocks white or yellowish. Many tame individuals are mottled and some are white throughout. Horns blackish throughout.

Dimensions. Considerably less than in *B. gaurus*, especially in height. The skull of an old bull known to be that of a wild animal measures 16·2 inches in basal length, 8·5 in breadth across the orbits, length of nasals 6·5, length of horn 14, girth at base the same. I have seen much longer horns on a tame animal.

Distribution, &c. The history and range of this animal are

GSL

Singularly obscure. *Bos frontalis* was described by Lambert and Colebrooke as occurring both in the tame and wild state in the hills of Tipperah amongst the Kukis; and Lambert gave a detailed account, furnished by Mr. McRae, of the capture of wild animals and their domestication by these tribes. It has since been ascertained that tame "mithans" or "gayals" are found in possession of particular tribes both north and south of the Assam valley, around Manipur and Cachar, and in the Tipperah, Chittagong, and Lushai hills as far south as the neighbourhood of Chittagong. But the wild bovine of the area in general was ascertained by Blyth, Sarbo, Anderson, and others to be *Bos gaurus*. The later evidence is confusing. Peal ('Nature,' Nov. 5th, 1885, p. 7) states that both wild and tame animals are called *Mithan* in Upper Assam, that they are perfectly distinct, and no intermediate forms ever occur; whilst Sanderson ('Thirteen Years &c.,' p. 250) declares that in Chittagong the two forms, wild and tame, are similar. Lastly, Mr. E. C. Steuart Baker ('Asian,' March 6th, 1891, p. 358), in the North Cachar hills confirms the old story of the wild mithans being reclaimed and domesticated by the Kukis.

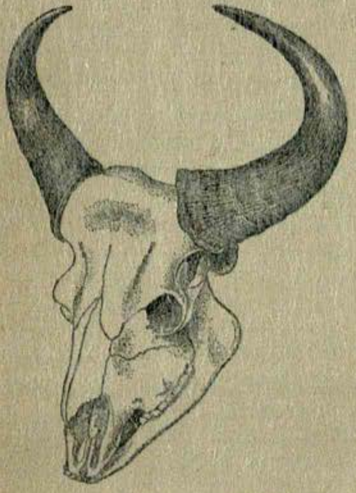

Fig. 159.—Skull and horns of *Bos gaurus.*

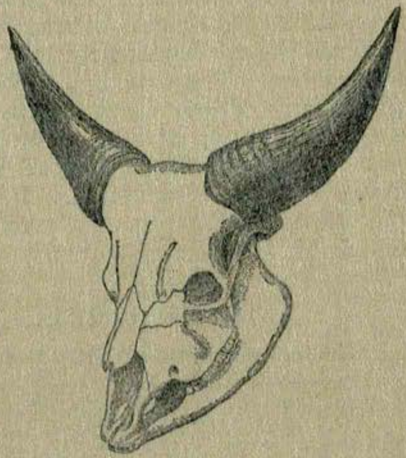

Fig. 160.—Skull and horns of *Bos frontalis.*

Much confusion has doubtless arisen from the terms Mithan and Gayal being used for both *B. frontalis* and *B. gaurus* (Gayal is a word of Sanscrit derivation applied to *B. gaurus* in parts of India, and not used by the Indo-Chinese tribes who alone own *B. frontalis*). But it is very probable that some of the domesticated "mithans" are *B. gaurus*, the domestication of which by the Kukis was described by Blyth on information from a missionary, M. Barbe (J. A. S. B. xxix, p. 294). This would explain the old accounts of Mr. McRae and the recent one by Mr. Baker, both of which have every appearance of authenticity.

GSL

Until quite recently there were grounds for supposing that the wild "mithan" of the mishmi hills, Upper Assam, might be *Bos frontalis*, but, as already mentioned under *Bos gaurus*, this appears not to be the case. A few days before these pages were sent to press, I saw, in Mr. Hume's private collection, a typical skull of *B. frontalis*, obtained by Mr. W. Davison in Tenasserim, and distinctly identified by him as that of a wild animal killed in Tenasserim, between Lemyne, 66 miles south by east of Moulmein, and Tenasserim town. This is, I believe, the first distinct record of the occurrence of *B. frontalis* in the wild state. The range of the species is still a question to be solved.

The tame herds of *B. frontalis* are kept for food, and according to some authorities for their milk, though this is doubtful, as most of the Indo-Chinese tribes who keep mithans never drink milk. The animals appear never to be employed in agricultural labour, nor as beasts of burden. They roam and feed unattended through the forest during the day, and return to their owner's village at night. They breed at times freely with the common humped cattle, and the progeny has been crossed with other bovines (Bartlett, P. Z. S. 1884, p. 399). The period of gestation is said by one writer to be ten months, by another eleven, but further information on this point is desirable.

340. **Bos sondaicus.** *The Banting.*

Bos sondaicus, *Müller & Schleg. Verhandl.* p. 197, pls. xxxv–xxxix (1839); *Blyth, J. A. S. B.* xi, p. 445, xxxi, p. 336; *id. Mam. Birds Burma*, p. 48; *W. Blanf. P. Z. S.* 1890, p. 593; *W. Sclater, Cat.* p. 127.

Bibos banting, *Gray, Knowsley Menagerie*, p. 48 (1850); *Horsfield, Cat.* p. 183.

Bos banteng, *Wagner, Schreb. Säugth. Suppl.* v, p. 473.

Gavæus sondaicus, *Blyth, J. A. S. B.* xxix, p. 293; *id. Cat.* p. 160.

Tsaing, Burmese; *Sapi-utan*, Malay.

This animal appears to be slighter than the gaur, with the legs longer in proportion and the dorsal ridge less developed. The tail descends below the hocks. The dewlap is of moderate size. The head is much more elongate, the forehead not concave, the horns smaller, cylindrical in the young, flattened towards the base in adults, and curving outwards and upwards at first, and towards the tips somewhat backwards and inwards.

Colour. Cows and young bulls have the head, body, and upper portions of the limbs bright reddish brown, approaching chestnut, old bulls are black; in both sexes the legs from above the knees and hocks, a large oval area on the buttocks, extending to the base of the tail but not including it, a stripe on the inside of each limb, the lips, and the inside of the ears are white. Calves have the outside of the limbs chestnut throughout and a dark line down the back.

Dimensions. According to S. Müller, a full-grown Javan bull measured 5 ft. 9½ in. high at the shoulder, the length of the head and body was 8 ft. 6 in., and of the tail 3 ft. The largest Burmese specimen recorded was 16 hands high (5 ft. 4 in.). A skull from Java in the Indian Museum, Calcutta, has horns measuring 30 inches long by 17 inches in circumference at the base. This is unusually large. A male skull from Borneo in the British Museum measures 17·75 inches in basal length by 8·75 in zygomatic breadth.

Distribution. Throughout Burma and the Malay Peninsula, also in the islands of Borneo, Java, and Bali. This species is probably found also in Sumatra and Siam. It extends north to Northern Pegu and Arrakan, and probably to the hill-ranges east of Chittagong.

Habits. So far as is known, similar to those of *Bos gaurus*, except that *B. sondaicus*, from the greater proportional length of the legs, is probably less of a climber and more restricted to the plains of high grass.

The banting is domesticated in Java, and perhaps in other parts of its range.

341. **Bos grunniens.** *The Yak.*

Bos grunniens, *L. Syst. Nat.* i, p. 99 (1766); *W. Sclater, Cat.* p. 128.

Bos poëphagus, *H. Smith, Griffith's An. King.* iv, p. 404 (1827).

Bison poëphagus, *Hodgson, J. A. S. B.* x, pp. 449, 912, xi, p. 282, xvi, p. 708.

Poëphagus grunniens, *Gray, List Mam. B. M.* p. 153 (1843); *Horsfield, Cat.* p. 184; *Adams, P. Z. S.* 1858, p. 529; *Blyth, Cat.* p. 158.

Dong, Brong-dong (wild), *Pegu* (tame), Tibetan; *Yak*, Tibetan of Ladak and N. Kumaun; *Ban-chour*, H.; *Kuch-gau*, P.; *Boku* (old ♂), *Kotass*, Kirghiz.

The form is massive, high at the shoulder, back nearly level, not falling away above the hips. Legs short and thick; hoofs large, rounded. Muzzle small. Ears small. No dewlap. Hair nearly smooth on upper parts and sides, very long on lower part of each side, forming a deep fringe extending across the shoulder and thigh. A tuft of long hair also on the breast. Terminal half of tail thickly covered with long hair, forming an enormous tuft, not descending in general below the hocks. Ribs 14 pairs. Head elongate. Forehead nearly flat. Horns smooth, round, slightly oval at the base in very old animals, curving outward and upward at first, then forward, then inward and upward, and slightly backward in some at the end.

Colour dark brown, almost black, throughout, with the exception of a little white about the muzzle, and a sprinkling of grey on the head and neck in old animals. Old bulls are reddish on the back.

Dimensions. According to Captain E. Smyth (J. A. S. B. xxx, p. 393) some bulls are nearly 18 hands (6 feet) high; the same is stated by Prejvalski and others. A bull 16½ hands (5 ft. 6 in.) high measured from horns to root of tail 7 ft. 3 in.; length of tail (with hair) 3 ft. 4 in., girth round chest 7½ feet. A bull weighs,

GSL

according to Prejvalski and Dalgleish, about 1200 lbs. Basal length of a large skull 20 inches; orbital breadth 11. Good horns measure 25 to 30 inches in length round the curve; the largest recorded is 40 long, and nearly 19 in girth at the base. Cows are considerably smaller than bulls and have smaller horns.

Distribution. The plateau of Tibet at considerable elevations, from about 14,000 or 15,000 to 20,000 feet in summer; and part of the Kansu province of China. The wild yak is only found within Indian limits in Northern Ladak, especially about Chang Chenmo.

Habits. The wild yak, according to Kinloch ('Large Game Shooting,' ed. 2, p. 82) and Prejvalski ('Mongolia,' &c., D. Morgan's translation, ii, p. 187), inhabits the coldest, wildest, and most desolate mountains, and is found at a greater elevation than any other mammal. In summer the cows and young collect in herds of from ten to upwards of a hundred in number. Bulls are generally solitary or in small parties of 3 or 4, except in the rutting-season, when each bull separates 4 or 5 cows from the main herd and remains with them. They feed morning and evening, mainly on a rough wiry grass that grows in the high Tibetan valleys, and usually betake themselves to a steep barren hill-side, often at a great elevation, to rest during the day. They require plenty of water, and in winter eat snow. Their powers of sight and hearing are far less acute than their sense of smell. They are timid animals, but wounded yak sometimes charge, as do most bovines.

Domesticated yaks are largely kept by Tibetans and by various tribes inhabiting the higher Himalayas, for their milk, as beasts of burthen, and for food. They are smaller than wild yaks and vary in colour, many being white or piebald; the white tails are the *chowris* of India, used as fly-flaps. They rut in winter, and bear young in autumn after a period of gestation of 10 lunar months according to Hodgson. They breed freely with domestic cattle.

342. **Bos bubalus.** *The Buffalo.*

Bos bubalis, *L. Syst. Nat.* i, p. 99 (1766); *W. Sclater, Cat.* p. 129.
Bos arnee, *Kerr, An. King.* p. 336 (1792); *Gray, A. M. N. H.* (2) xvi, p. 230 (1855); *id. P. Z. S.* 1855, p. 17, pl. xl.
Bos buffelus, *Blumenbach, Handb. Naturgesch.* p. 121 (1821); *W. Blanf. J. A. S. B.* xxxvi, pt. 2, p. 195.
Bubalus arna, *Hodgson, J. A. S. B.* x, pp. 469, 912 (1841), xvi, p. 709; *Horsfield, Cat.* p. 179.
Bubalus buffelus, *Kelaart, Prod.* p. 87; *Blyth, Cat.* p. 163.
Bubalus arni, *Jerdon, Mam.* p. 307; *Blyth, Mam. Birds Burma*, p. 49.

Arna ♂, *Arni* ♀, H.; commonly *Arna bhainsa, Jangli bhains* (*bhains*, tame buffalo); *Mang*, Bhagalpur; *Mains*, Bengali; *Bir Biar*, Ho-Kol; *Gera erumi*, Gond; *Mi Harak*, Cingalese; *Moh*, Assamese; *Siloi*, Kuki *Gubui, Rili, Ziz, Le*, Naga; *Misip*, Cachari; *Iroi*, Manipuri; *Kywai*, Burmese; *Pana*, Karen; *Karbo*, Malay.

General form heavy, body massive, legs thick and short, hoofs large. Tail reaching the hocks (but, I think, variable in length). Ribs 13 pairs. Hair on the body very thin, especially in old animals. Muzzle large and square. Head carried very low.

Skull elongate, nasals long, forehead nearly flat. Horns very large, flattened, transversely rugose, trigonal in section, tapering slowly and gradually from the base, curving at first upward, outward, and slightly backward from the plane of the face, the curve increasing towards the ends, where the horns curve inwards and a little forwards. The horns depart but little from one plane throughout. In some (*macrocerus* of Hodgson) the horns are almost straight till near the end, where they turn more rapidly upward.

Colour throughout dark ashy, almost black. The legs are sometimes whitish; in some tame forms the legs are white to the same height as in the Gaur. Horns black.

Dimensions. According to Jerdon (who probably took the figures from Hodgson) and others, the wild buffalo measures in height up to 6½ feet, and in length from snout to root of tail 10½. Kinloch, however ('Large Game Shooting,' ed. 2, pp. 88, 91), doubts if any exceed 5 ft. 4 in. in height (16 hands), and gives the following measurements of a good-sized bull: height 5 ft., length from nose to root of tail 9 ft. 7 in.; tail 3 ft. 11 in.; girth 8 ft. 3 in.; length of horns from tip to tip round curve 8 ft. 3 in. This is a common way of measuring buffalo horns. The longest recorded single horn known, one in the British Museum, measures 78½ inches, which would give an outside sweep of about 14 feet. Cows' horns are longer than bulls', but of less girth. Basal length of a large bull's skull 22·8 inches, orbital breadth 10·25.

Distribution. Plains of the Brahmaputra and Ganges from the eastern end of Assam to Tirhoot, and the Terai as far west as Rohilcund, the plains near the coast in Midnapore and Orissa, and also plains in the Eastern Central Provinces (Mandla, Raipur, Sambalpur, Bastar, and other districts) as far south as the Godávari and Pranhita rivers, and perhaps a little beyond. Wild buffaloes are wanting in Southern and Western India, but abundant in Northern Ceylon. Some buffaloes are also found in the wild state in Burma and the Malay Peninsula, but it is uncertain whether they are not descended from herds escaped from captivity.

Varieties. Besides the two forms, one with horns approaching a circle (*spirocerus* of Hodgson) and the other with horns nearly straight at first and turned up at the end (*macrocerus* of Hodgson), there is a very distinct race of a dun colour that inhabits Upper Assam. I have seen two heads of bulls, one in Mr. Hume's collection now in the British Museum, the other in the Indian Museum, Calcutta. These differ in the much more convex forehead, and the skull is remarkably short in front of the orbits, the nasals being shorter than the distance from their posterior end to the vertex, whilst in ordinary buffaloes they are longer. This difference is so great that the form requires a distinctive name, and may be called *Bos bubalus*, var. *fulvus*, or the dun buffalo.

Habits. The wild buffalo keeps chiefly to level ground and is generally found about swamps. It haunts the densest and highest grass-jungle or reeds, but is also found at times in open plains of short grass, or amongst low bushes, but very rarely in tree-forest. Buffaloes associate in herds, often of large size. I have seen 50 together, and have heard of much larger assemblages. They feed chiefly on grass, in the evening, at night, and in the morning (probably morning and evening as a rule), and lie down, generally in high grass, not unfrequently in a marsh, during the day; they are by no means shy, nor do they appear to shun the neighbourhood of man, and they commit great havoc amongst growing crops. Sometimes a herd or a solitary bull will take possession of a field and keep off the men who own it. In fact buffaloes are by far the boldest and most savage of the Indian *Bovidæ*, and a bull not unfrequently attacks without provocation, though, probably on the principle that a council of war never fights, a herd, although all will gallop to within a short distance of an intruder and make most formidable demonstrations, never, I believe, attacks anyone who does not run away from them. A wounded animal of either sex often charges, and has occasionally been known to knock an elephant down. Buffaloes retain their courage in captivity, and, as mentioned already (*ante*, pp. 63, 67), a herd will attack a tiger or other dangerous animal without hesitation, and, although gentle with those they know and greatly attached to them, they are inclined to be hostile to strange men and strange animals. Whether wild or tame they delight in water, and often during the heat of the day lie down in shallow places with only parts of their heads above the surface.

Few, if any, tame animals have changed less in captivity than buffaloes. Unlike the yak and gayal, they never breed with tame cattle (*B. indicus*), although the cows often pair with wild bulls of their own species. Tame buffaloes are chiefly kept for milk and for draught. They have been introduced throughout many of the warmer parts of the Old World, and even in Italy, whither they were brought in the sixth century (Griffith's Cuvier, iv, p. 381). Both wild and tame rut in autumn; the females gestate for 10 months (10 months and 10 days according to some), and bear one or two young in summer.

Genus **OVIS**, Linn. (1766).

Syn. *Ammotragus*, Blyth (1840); *Pseudoïs*, Hodgson (1846); *Caprovis*, Hodgson (1847).

Tail short in all wild Asiatic forms. Suborbital gland and lachrymal fossa usually present (wanting in *O. nahura*). Interdigital glands present on all feet. Inguinal glands present. No muffle. No beard on chin, but frequently long hair on neck. Mammæ two. Males non-odorous.

Skull broadest at the orbits, which are prominent, and narrowing suddenly in front of them; the frontal and occipital planes, the

GSL

latter including the parietal region, meeting at about a right angle. Occipital plane very flat. Horns in both sexes, very large in males, much smaller in females; in the former thick, sometimes very thick at the base, tapering regularly, and forming a circular or spiral curve at the side of the head (*O. nahura* is an exception). Vertebræ: C. 7, D. 13, L. 6, S. 4, C. 10–14.

Wild sheep are found in the Palæarctic and Nearctic regions, one species ranging into Sind and the Punjab. The structural differences from the genus *Capra*, comprising the true goats, are very small, and one species, *O. nahura*, is absolutely intermediate. Both inhabit mountains and high plateaus, but the sheep keep more to open undulating ground, the goat to crags and precipices. The flesh of all wild sheep is excellent, the males never having the rank odour that is characteristic of goats.

The period of gestation in different breeds of European tame sheep varies from 144 to 150 days, but, according to Hodgson, in several Himalayan and Tibetan breeds the period is 160 (J. A. S. B. xvi, pp. 1010 &c.). The origin of tame sheep is quite unknown.

Synopsis of Indian Species.

A. Normal; suborbital glands present, horns with a circular or spiral curve.
  a. Very large; adults exceeding 42 inches in height at shoulder.
    a'. Horns in male never exceed one circle .. *O. hodgsoni*, p. 494.
    b'. Horns in male considerably exceed a circle. *O. poli*, p. 496.
  b. Size moderate; adults not exceeding 36 inches in height .... *O. vignei*, p. 497.
B. Abnormal; no suborbital glands, curve of horns S-shaped .... *O. nahura*, p. 499.

343. **Ovis hodgsoni.** *The great Tibetan Sheep.*

Ovis nayaur, *Hodgson, As. Res.* xviii, pt. 2, p. 135 (1833), *partim.*
Ovis hodgsoni, *Blyth, P. Z. S.* 1840, p. 65; *id. A. M. N. H.* vii, p. 199 (1841); *Sclater, P. Z. S.* 1860, p. 129; *V. & B. Brooke, P. Z. S.* 1875, p. 520; *W. Sclater, Cat.* p. 136.
Ovis ammonoides, *Hodgson, J. A. S. B.* x, p. 230, pl. i, fig. 1 (1841); xv, p. 338, with 3 plates; *Hutton, J. A. S. B.* xvi, p. 568.
Ovis ammon, *Horsfield, Cat.* p. 176; *Blyth, Cat.* p. 177; *Blanford, J. A. S. B.* xli, p. 40, *nec* Capra ammon, L.
Caprovis argali, *Adams, P. Z. S.* 1858, p. 527, *nec* Ovis argali, Pallas.

Nyan ♂, *Nyanmo* ♀, Ladak; *Nyang, Nyand, Hyan*, Tibetan.

Hair short, coarse, and very close. Ears short. Tail very short. In adult males the hair on the sides and lower surface of the neck is lengthened into a white ruff, and there is a dark crest of hair, not so long as the ruff, along the back of the neck to the withers.

Horns in male very massive, coarsely wrinkled transversely, subtriangular in section, but with the edges, especially the fronto-orbital, much rounded, the orbital and nuchal surfaces very much broader than the frontal. The curve is a spiral, the two horns

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diverging very slowly, tips turned very little outwards, and the whole curve of each horn not equal to a complete circle. In females the horns are short, erect, curved backwards and outwards, thin and strap-like towards the ends.

Colour greyish brown above, paler and whitish below. In males the caudal disk surrounding the tail, the rump, throat, chest, belly, and insides of the legs are white, crest and a stripe down the front of each leg dark. Old males are grizzled on the back, white hairs being mixed with the brown of the upper parts. A dark mark above the tail. Females have little or no mane, the white is less pure, and the caudal disk is indistinct. The colour in winter is probably paler than in summer.

Dimensions. Height of old rams at shoulder 3½ to 4 feet, females not much less. Length from nose to rump (skins), males 6 to 6½ feet, females 5½; tail without hair 1 inch, with hair 3; ear 6; basal length of male skull 13, breadth at orbits 7·5. Horns of adult males are 36 to 40 inches long round the curve, and the girth at the base is 16 to 17. The greatest recorded measurements are said to be, length 53, basal girth 24 or perhaps 25, but there appears a little doubt about these. 48 inches in length and 20 in girth have certainly been measured. Female horns are said to attain 24 inches in length, but rarely exceed 18.

Distribution. The plateau of Tibet from Northern Ladak to the country north of Sikhim and probably farther east. This sheep does not range south of the main Himalayan axis; it is not found in summer below about 15,000 feet elevation; in winter it may descend to about 12,000 in places.

Habits. This magnificent sheep, probably the largest of the genus, inhabits the bare undulating Tibetan plateau in herds, keeping to open valleys and low stony slopes. In summer the rams are found in small parties of from 3 or 4 to about 15, apart from the ewes. The rutting-season is in winter; at this time the great sheep inhabit the lower and more sheltered Tibetan valleys. The young are born about May or June.

No animal is more wary. Owing to its watchfulness, its keen sight and acute sense of smell, its speed when on foot, and the open character of the ground it haunts, the great Tibetan sheep is one of the most difficult of all animals to stalk or shoot.

Ovis brookei (P. Z. S. 1874, p. 143; 1875, p. 521) has now been ascertained to be a wild hybrid between a male *O. hodgsoni* and female *O. vignei* (Sterndale, Jour. Bombay N. H. Soc. i, p. 35, and P. Z. S. 1886, p. 205)—a male of the great sheep in Zaskar having taken possession of a small flock of *O. vignei* ewes, and bred with them. The converse, a hybrid between the male *O. vignei* and female *O. hodgsoni* has also been shot by Major C. S. Cumberland (P. Z. S. 1885, p. 851). The hybrid in the latter case was found with a flock of *O. hodgsoni*.

Ovis ammon, L. sp. (*O. argali*, Pall.), inhabits plateaus in Northern Mongolia, and perhaps in Southern Siberia. It is nearly allied to *O. hodgsoni*, but appears to have no ruff.

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344. **Ovis poli.** *The great Pamir Sheep.*

Ovis poli, *Blyth, P. Z. S.* 1840, p. 62; *id. A. M. N. H.* vii, p. 195, pl. v, figs. 1, 2, 3, 4; *Stoliczka, P. Z. S.* 1874, p. 425, pl. liii; *Biddulph, P. Z. S.* 1875, p. 157; *id. P. A. S. B.* 1879, p. 280; *Scully, P. Z. S.* 1881, p. 209; *Blanford, P. Z. S.* 1884, p. 326; *W. Sclater, Cat.* p. 133.

Ovis poli *and* karelini, *Severtzoff, Turk. Jev.* pp. 84–102, 149, pls. i–vi (1873); *id. A. M. N. H.* (4) xviii, pp. 171, 210, 217, 220 (1876); *V. & B. Brooke, P. Z. S.* 1875, pp. 512, 514; *Blanford, Yark. Miss., Mam.* pp. 80, 83.

Kuchkár ♂, *Mesh* ♀, Wakhan; *Kulja* or *Gulja* ♂, *Arkar* ♀, Turki (E. Turkestan).

Closely allied to *O. hodgsoni*, from which this great sheep is distinguished chiefly by the form of the horns, partly by colour. It has a white ruff on the throat and dark crest on the nape. The horns in adult males are enormous, less in girth than in *O. hodgsoni*, but much longer, each forming a spiral of considerably more than a circle. Horns in the female compressed, very similar to those of *O. hodgsoni*.

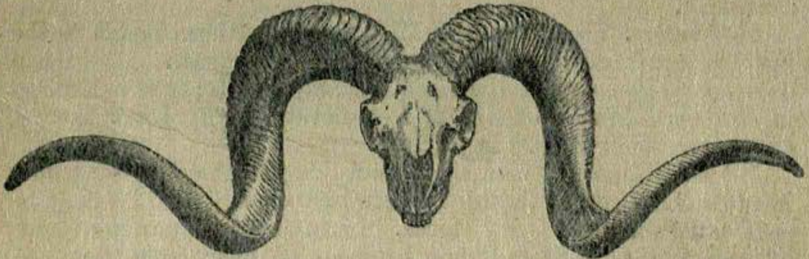

Fig. 161.—Skull and horns of *Ovis poli*. (Guide to the Galleries of Mammalia, British Museum.)

Colour. Upper parts rather light brown or hoary brown, more or less tinged with rufescent, especially towards the border of the dark area, a darkish line of slightly lengthened hair from the nape to the withers. Lower parts, with the fore part of the neck, muzzle, chest, legs, and rump, including the tail, white; a dark mark sometimes on the tail. In summer the colour is probably darker and browner. In females the neck is brown in front.

Dimensions of an adult male with 48-inch horns:—height at shoulder 44 inches; length of head 13·25; from horns to tip of tail 62; tail with hair 5·5, without 4; length of ear in front 4·75; girth round chest 51·5 (*Stoliczka*). Basal length of a good skull 12·7, breadth across orbits 7·5. Females are not much smaller than males. Good horns of rams measure 50 to 60 inches round the curve and about 15 in girth at the base, the extreme recorded measurements being 75 and 16·75. Severtzoff estimates the weight of an old male at about 600 lbs., but he did not weigh one.

Distribution. The high Pamir and the plateaus west and north of Eastern Turkestan, extending to the Alai. This sheep only comes within Indian limits in Hunza, north of Gilgit.

Habits. Precisely similar to those of *O. hodgsoni*. The rutting-season is in December and January. Some herds at this time are large.

345. Ovis vignei. *The Urial or Shá.*

Ovis vignei, *Blyth, P. Z. S.* 1840, p. 70; *id. A. M. N. H.* vii, p. 251, pl. v, fig. 9 (1841); *Hutton, J. A. S. B.* xv, p. 152; *Horsfield, Cat.* p. 175; *Sclater, P. Z. S.* 1860, p. 127, pl. lxxix; *Scully, P. Z. S.* 1881, p. 209; *W. Sclater, Cat.* p. 139.
Ovis cycloceros, *Hutton, Calc. Jour. N. H.* ii, p. 514, pl. xix (1842); *Sclater, P. Z. S.* 1860, p. 128, pl. lxxx; *Blyth, Cat.* p. 177; *Jerdon, Mam.* p. 294; *Blanford, Eastern Persia*, ii, p. 87; *Thomas, Tr. L. S.* (2) *Zool.* v, p. 63; *W. Sclater, Cat.* p. 138.
Ovis montana, *Cunningham, Ladak*, p. 199, pl. vii (1854), *nec* G. Cuvier.
Caprovis vignei, *Adams, P. Z. S.* 1858, p. 526.
Ovis blanfordi, *Hume, J. A. S. B.* xlvi, pt. 2, p. 327, pl. iv. (1877).

Guch ♂, *Mish* ♀, P.; *Shá* (*Shápo* ♂, *Shámo* ♀), Ladak; *Urin*, Astor; *Koh-i-dúmbá*, Afghanistan; *Koch*, *Gad* ♂, *Garand* ♀, Baluch and Sindhi; *Kar* ♂, *Gad* ♀, Brahui; *Uriál*, Punjab.

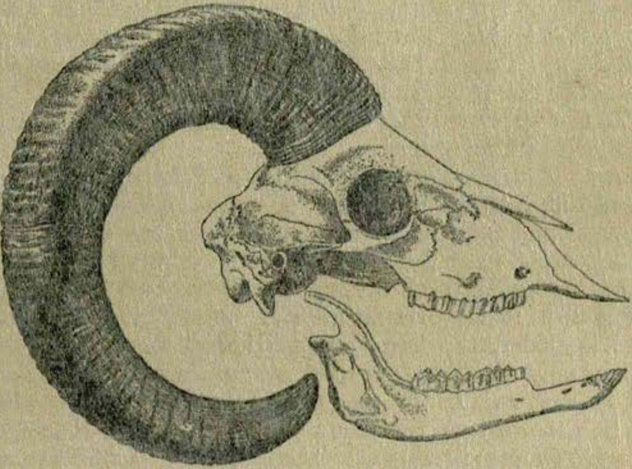

Fig. 162.—Skull and horns of *Ovis vignei* (Salt Range variety).

Fur coarse, close and short. Tail short. Adult rams have a gular ruff of long hair commencing behind the chin in two lobes, which immediately unite and extend down the middle of the throat to the chest.

Horns in male coarsely wrinkled transversely, triangular in section; orbital and nuchal surfaces not very much broader than frontal; fronto-orbital edge sometimes much rounded, the others, as a rule, less so. The two horns arise close together, diverge considerably, and are curved round nearly in a circle, sometimes keeping almost, or even absolutely, in one plane, sometimes wound spirally. The curve very rarely exceeds a circle. Horns of females are short and nearly straight.

Colour above in summer rufous grey or fawn, in winter light greyish brown; lower parts, limbs, buttock, and tail whitish or white; ruff sometimes black throughout, but generally with some white hairs and in old rams white in front, gradually passing into black behind. Muzzle in old animals whitish or white. A patch behind the shoulder black or blackish, sometimes a blackish lateral line and markings outside the limbs. Females and young males are almost uniform greyish brown, paler beneath.

Dimensions. Height of a male 32 inches, length 48, tail 4. Some Ladak specimens are larger and are said to be 3 feet or more in height. A male Ladak skull measures 9·25 in basal length, and 5·5 in breadth across the orbits. A Punjab skull is about half an inch less in length. Horns measure 24 to 30 inches round the curve, and about 10 in girth at the base, the maximum recorded length and girth being 37·75 and 11·5.

Distribution very wide. The shá is found in Ladak and Zaskar, and, according to information obtained by Mr. Hume from Mr. Dalgleish, considerably farther east in Northern Tibet, at elevations of 12,000 to 14,000 feet, and it ranges through Astor and Gilgit, where it is known as úrin, to Afghanistan. The Astor animal is the typical *O. vignei*. The uriál, which I now regard as identical, is found in the Punjab Salt Range and in places throughout the ranges west of the Indus in the Punjab and Sind down to the sea-level. To the westward this animal is found throughout Afghanistan, Baluchistan, and Southern Persia.

Varieties. Until recently I believed, as Sclater, Blyth, Jerdon, and others did, that the Ladak shá, *O. vignei*, was distinct from the Punjab, Sind, and Baluchistan uriál, usually known as *O. cycloceros*. But an examination of the series of skulls collected by Mr. Hume shows the impossibility of distinguishing the two by the horns. The shá is undoubtedly, on an average, larger, the circle made by the horns is wider, the horns are thicker at the base, and their edges, especially the fronto-orbital, are more rounded as a rule; the ruff, too, is said to be much less developed. According to some MS. notes for which I am indebted to Mr. Hume, horns of uriál scarcely ever exceed 10 inches in girth at the base, whilst shá horns are sometimes between 11 and 12 in circumference. Judged by this test, as Mr. Hume has pointed out to me, the typical *O. cycloceros* of Hutton is identical with *O. vignei*, and the smaller uriál, if kept distinct, must bear a different name. But I cannot find any definite distinctive characters; those of colour noted by Sclater I believe to be merely individual, and some skulls and horns from Ladak appear indistinguishable from Salt Range specimens.

O. blanfordi is a variety of the uriál from Kelát, Baluchistan, with horns diverging throughout so as to form an open spiral, instead of each lying in one plane or nearly so. Thus the tips of the horns are very much farther apart than in typical *O. vignei*. This character, I am now convinced, is not of specific importance, and in this view Mr. Hume agrees.

Habits. In Ladak this sheep inhabits open valleys; in Astor and Gilgit it keeps to grassy ground at moderate elevations below the forest; in the Salt Range of the Punjab, and in Sind, Baluchistan, and Persia, it is found on undulating or hilly ground cut up by ravines, and is more often seen on stony and rocky hill-sides than amongst bushes and scrub. The herds vary usually from 3 or 4 to 20 or 30 in number; the sexes are generally together, but the males often keep apart in summer. These sheep are wary and active; although not such masters of the art of climbing amongst precipices as the goats, tahr, or bharal, they get over steep places with wonderful ease. Their alarm cry is a shrill whistle, their usual call a kind of bleat.

The rutting-season in the Punjab is September. According to Adams the period of gestation is 7 months, but according to Sclater (P. Z. S. 1863, p. 230), from observations in the Zoological Gardens in London, only 4. It is not improbable that the true period is between the two. The young in Astor are produced about the beginning of June, as observed by Mr. H. Littledale, and the rutting-season there must be considerably later than September. One or two young are born. This species has bred freely with tame sheep. The occurrence of wild hybrids with *O. hodgsoni* has been noted in the account of the latter. The flesh of *O. vignei* is excellent.

346. **Ovis nahura.** *The Bharal or blue Wild Sheep.*

Ovis nayaur, *Hodgson, As. Res.* xviii, pt. 2, p. 135 (1833).
Ovis nahoor, *Hodgson, P. Z. S.* 1834, p. 107; *id. J. A. S. B.* x, p. 231, pls. i, ii, p. 913, xi, p. 283; *Sclater, P. Z. S.* 1860, p. 129; *M.-Edw. Rech. Mam.* p. 357, pls. lxviii, lxix; *W. Sclater, Cat.* p. 140.
Ovis burrhel, *Blyth, P. Z. S.* 1840, p. 67; *id. A. M. N. H.* vii, p. 248; *id. J. A. S. B.* x, p. 868.
Ovis nahura, *Gray, List Mam. B. M.* p. 170 (1843); *Blyth, Cat.* p. 178; *Jerdon, Mam.* p. 296; *Blanford, J. A. S. B.* xli, pt. 2, p. 40; *id. Yark. Miss., Mam.* p. 85, pl. xiv.
Pseudoïs nahoor, *Hodgson, J. A. S. B.* xv, p. 343, xvi, p. 702; *Horsfield, Cat.* p. 176; *Adams, P. Z. S.* 1858, p. 527; *Lydekker, J. A. S. B.* xlix, pt. 2, p. 131.

Bharal, Bharar, Bharut (males often *Menda*, a ram), H.; *Na, Sna*, Ladak; *Wa, War*, Sutlej Valley; *Nervati*, Nepal; *Nao, Gnao*, Bhotia.

Hair of uniform length throughout, no trace of mane or ruff. No suborbital glands nor lachrymal fossæ, but interdigital and inguinal glands present. Ears short. Tail longer than in *O. vignei* and *O. hodgsoni*.

Horns in males rounded at the base or subquadrangular, nearly smooth, with transverse striæ, arising close together, curving outwards, first upwards, then downwards, and lastly backwards. In females the horns are short, slightly curved upwards and outwards, suboval in section, the longer diameter across the head.

Colour brownish grey above, much browner in summer, slaty grey with a brownish wash in winter. Lower parts, inside and back of limbs, and buttocks as far as base of tail white. In adult males the face, chest, a stripe down the front of all limbs, but broken by white at the knees in the fore limbs, a band down the lower part of the side bordering the white of the belly, and the terminal two-thirds of the tail black. The black markings on the face, chest, and sides are wanting in females.

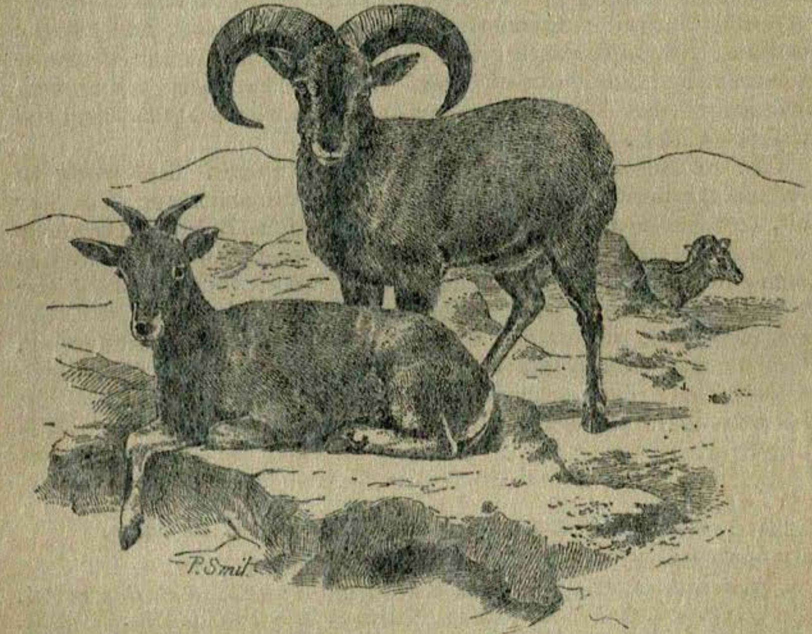

Fig. 163.—*Ovis nahura.*

Dimensions. Height at shoulder in males about 3 feet, length to root of tail 5, tail 7 inches; horns about 24 round curve, girth at base about 11; the greatest recorded dimensions being length 32·1 and 30·5, girth 13; basal length of skull 9·5, breadth across orbits 5·6. Females considerably smaller in all dimensions.

Distribution. Tibet from near Shigar in Baltistan, and near Sanju S.E. of Yarkand, to Moupin, and from the main Himalayan axis, or in places the high ground south of it, to the Kuenlun and Altyn Tágh. Never found below about 10,000 feet. In summer usually seen about 14,000 to 16,000.

This animal in structure is quite as much allied to *Capra* as to *Ovis*, and is referred to the latter genus mainly because it resembles sheep rather than goats in external appearance, and hence has been gene-

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rally classed with the former. Hodgson distinguished it as *Pseudoïs*, and there is much to be said in favour of the distinction, but the sheep and goats are so nearly allied that an intermediate generic form can scarcely be admitted.

Habits. In habits as in structure the bharal is intermediate between the sheep and the goats. Like the former it is found on undulating ground, and frequently lies down during the day on its feeding-ground, though generally amongst stones; but, like the latter, it is a splendid climber, perfectly at home on precipitous cliffs, and wont, when alarmed, to take refuge in ground inaccessible to man. It is found in herds of from 8 or 10 to 50 or even 100; the males and females being generally found apart in the summer, but frequently associating together at all seasons. The herds keep to high open ground above forest and never enter bush even. They feed and rest alternately during the day; owing to their colour it is peculiarly difficult to make them out when they are lying down amongst stones. Their flesh is excellent, especially about September, when they are in good condition.

The bharal is easily tamed if taken young, and has bred freely in the Zoological Gardens, Regent's Park. The period of gestation has not, however, been accurately determined; it is 160 days according to Hodgson. This animal has never been known to breed with tame sheep.

Genus **CAPRA**, Linn. (1766).

Syn. *Hircus*, Bodd. (1785); *Ibex*, Hodgson (1847).

Size moderate. Tail short. No suborbital nor inguinal glands. Interdigital glands wanting or confined to fore feet. No distinct muffle. A beard present in all Indian species. Mammæ two. Callosities on the knees and sometimes on the chest. Males with a peculiar strong odour.

Skull broad at the orbits and narrowing rather suddenly in front, the occipital and frontal planes meeting at an obtuse angle, occipital and parietal area much rounded, outline of face concave. Horns in both sexes, very (30 to 54 inches) long and arising close together in adult males, much smaller and farther apart in females, commencing from the vertex and rising above the continuation of the frontal plane, scimitar-shaped or spiral, more or less compressed and angulate. Vertebræ: C. 7, D. 13, L. 6, S. 3–4, C. 9–13.

The true goats are almost confined to the Palæarctic region. All live in herds, the males sometimes keeping apart from the females and occasionally being found solitary. All haunt steep cliffs and are splendid climbers, and all browse largely. They are very wary and active. The period of gestation in tame goats is about 160 days (Hodgson, J. A. S. B. xvi, pls. 1020, 1021, &c.), and is probably similar in their wild allies.

Synopsis of Indian Species.

A. Horns scimitar-shaped.
  a. Horns compressed in front.............. *C. ægagrus*, p. 502.
  b. Horns of males flattened in front, with knobs at intervals...................... *C. sibirica*, p. 503.
B. Horns spirally twisted .... *C. falconeri*, p. 505.

Remains of a goat, closely allied to *C. falconeri*, are found in the Pliocene Siwaliks, and traces of another species in the beds of Hundes in Tibet.

347. **Capra ægagrus.** *The Persian wild Goat.*

Capra ægagrus, *Gmelin, Syst. Nat.* i, p. 193 (1788); *Hutton, Calc. Jour. N. H.* ii, p. 521, pl. xix; *id. J. A. S. B.* xv, p. 161; *Blyth, Cat.* p. 176; *Blanford, J. A. S. B.* xliv, pt. 2, p. 15; *id. Eastern Persia*, ii, p. 89; *Danford, P. Z. S.* 1875, p. 458; *Sclater, P. Z. S.* 1886, p. 315, pl. xxxi; *W. Sclater, Cat.* p. 142.
Ægoceros ægagrus, *Kotschy, Verh. zool.-bot. Ver. Wien*, iv (1854), p. 201.
Capra caucasica, *Gray, List Mam. B. M.* p. 167 (1843); *Adams, P. Z. S.* 1858, p. 525, *nec Güldenstädt.*
Capra blythi, *Hume, P. A. S. B.* 1874, p. 240.

Pásang ♂, *Boz* ♀ (generally *Boz-pásang*), P.; *Borz*, Afghan; *Sair, Sarah, Phashin, Pachin*, ♂ *Borz-Kuhi*, Baluch; *Chank* ♂, *Hit, Haraf* ♀, Brahui; *Ter, Sarah*, Sindhi; *Sind ibex* of European sportsmen.

Male with a beard on the chin only, and with the hair on the back of the neck and on the shoulders rather longer in winter. At this season a soft underfur is developed in all individuals inhabiting cold climates.

Horns of male scimitar-shaped, curved backwards, greatly compressed, the anterior edge forming a prominent keel, irregularly notched and jagged, posterior edge rounded, the outer surface of each horn more convex than the inner; the tips generally converging more or less, sometimes diverging. Horns of female much smaller, erect, curved slightly backwards, farther apart at the base than in the male, slightly compressed, oval in section and ribbed.

Colour brownish grey in winter, yellowish or rufous-brown in summer, lower parts and inner portion of buttocks whitish or white. Older males are paler and have the face, back of the neck, shoulders, a stripe along the back, the tail, chin, and throat, with the beard, the front of all legs, except at the knees, and a stripe along the lower part of each side joining the band of the hind leg dark brown. The carpus and tarsus are all white except the dark band in front. These markings vary much in distinctness.

Dimensions. A full-grown male was 37 inches high at the shoulder, muzzle to end of tail 61·5, tail with hair 5 (*Hutton*). Females are less, and both sexes in Lower Sind are usually small. Basal length of a male skull 9·2, orbital breadth 4·8. Good horns measure 40 inches round the curve, the extreme length known being 52·5, with a basal girth of 7, in a specimen killed by General Marston in the Karáchi hill-tracts.

Distribution. The hills and mountains of South-western Asia, from the Caucasus to Sind. Formerly common in the Grecian Archipelago. Within Indian limits, this wild goat is found on the barren hills of Baluchistan and Western Sind, but not east or north-east of the Bolan Pass and Quetta, as it is replaced by *C. falconeri.* Specimens of a wild hybrid between the two were obtained by the late Sir O. B. St. John on Takatu near Quetta. This goat, which does not occur east of the Indus, is found near the sea-level in Sind and Baluchistan, but ascends to 12,000 or 13,000 feet in Persia.

Habits. The wild goat of Sind and Baluchistan inhabits barren rocky hills in herds of varying numbers, keeping much to cliffs and crags. It is very active, and leaps with wonderful precision from one ledge to another on the face of a precipice, having like other goats, as Hutton has pointed out, a peculiar power of stopping short and balancing itself on a very small foothold after a leap up or down. Hutton also states that he has seen a male of this goat, kept tame, save itself when it has made a false step by falling on its horns.

One or two kids, sometimes, it is said, three, are produced at a time, about May in the Caucasus, but I believe earlier in Sind, for I saw a very young animal captured in the Khirthar range on March 11th.

The true bezoar, formerly famous in Europe and still regarded in Persia as an antidote to poison, and as a remedy in many diseases, is a concretion found in the stomach of this goat, which was known to the older European writers as Pazen or Pasen, evidently a corruption of the Persian name. The *Capra bezoartica* of Linnæus was doubtless intended for this species, although the description cannot be recognized. The subject is fully discussed by Danford.

There can be no doubt that *C. ægagrus* is one of the species, and probably the principal, from which tame goats are derived.

348. **Capra sibirica.** *The Himalayan Ibex.*

Capra sibirica, *Meyer, Zool. Annal.* i, p. 397 (1794); *Blyth, Cat.* p. 176; *Jerdon, Mam.* p. 292; *Blanford, Yark. Miss., Mam.* p. 86; *Scully, P. Z. S.* 1881, p. 208; *Aitchison, Tr. L. S.* (2), *Zool.* v, p. 64; *W. Sclater, Cat.* p. 143.
Himalayan ibex, *Blyth, P. Z. S.* 1840, p. 80.
Capra ibex, *Hodgson, J. A. S. B.* x, p. 913, xi, p. 283, *nec Linn.*
Capra sakeen, *Blyth, J. A. S. B.* xi, p. 283 (1842).
Ægoceros skyn, *Wagner, Schreb. Säugeth. Supp.* iv, p. 491 (1844).
Capra himalayana, *Schinz, Syn. Mam.* ii, p. 463 (1845); *Adams, P. Z. S.* 1858, p. 523.
Ibex sakin *and* sibirica, *Hodgson, J. A. S. B.* xvi, p. 700.

Skin or *Sakin* ♂, *Dabmo* or *Danmo* ♀, Ladak; *Kail*, Kashmir; *Tangrol*, Kulu; *Buz*, Kunawár; *Skiu*, Balti.

Build rather heavy, legs short. Male with a profuse beard confined to the chin, and with a ridge of coarse dark hair along the back. Hair coarse and brittle, with, in winter, dense soft woolly underfur (pashm or tús).

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Horns scimitar-shaped, curved backwards, diverging, the points sometimes converging slightly; nearly triangular in section, the anterior surface flat, with large knobs at tolerably regular intervals, hinder edge compressed. In the female the horns are much smaller, set wider apart, rugose, almost ringed, oval in section at the base, compressed above, curving slightly backwards.

Colour in summer brown, scarcely paler beneath, old males being chocolate, with patches of dirty white on the back. In winter the general colour is yellowish white, tinged with brown or greyish. There is generally a dark band on the back. Legs dark. Beard and tail dark brown.

Dimensions. Height of males at shoulder about 40 inches; females one-third smaller (*Kinloch*). Basal length of a male skull 10·8; orbital breadth 6. Good horns of males measure 40 to 45 inches round the curve; the greatest recorded length is 54 with a girth of 11·5 inches above the lowest knob. Female horns measure about a foot in length.

Varieties. A very dark-coloured ibex is said to occur in Baltistan, but is, according to Scully, merely the old male in winter vesture. Ibex from Siberia and from the Thian Shan Mountains north of Káshgarh have the abdomen and the back of the carpus and tarsus white, contrasting strongly with the front of the legs, which is very dark brown. Colonel Biddulph, to whom I am indebted for calling my attention to this character, is of opinion that the Thian Shan animal is true *C. sibirica* and the Himalayan one distinct, in which case the latter would take the name of *C. sakin*. I have only been able to examine one undoubted Himalayan skin, and cannot say if the difference is constant.

Mr. R. A. Sterndale has described and figured (Jour. Bombay N. H. Soc. i, p. 24) the head of an ibex purchased in Kashmir. The horns are 52 inches long, dark coloured, and remarkably curved round, much more than in ordinary *C. sibirica*; there are no knobs except near the tips. In section the horns resemble those of *C. sibirica*. Three specimens are recorded, and it is suggested they may come from the country west of Kashmir. Mr. Sterndale proposed to call this wild goat *C. dauvergnei* if new.

Distribution. The mountain ranges of Central Asia from the Altai to the Himalayas, and from the neighbourhood of Herat to Kumaun. The ibex occurs in most of the high ranges north of Kashmir, but not in the Pir Panjál, and it also inhabits the higher Himalayas as far east at all events as the source of the Ganges. It is not known to occur farther east in the Himalayas nor in Eastern Tibet, and although it is included in Hodgson's lists of Nepal mammals, there are no specimens in his collection; but when in Northern Sikhim, I heard from Tibetans of an animal, probably this species, inhabiting the mountains north of Shigatze, and Hodgson obtained similar information as to its occurrence north of Lhassa and Digarchi.

Habits. The ibex of the Himalayas is found on and about precipitous cliffs at high elevations close to the snow at all seasons.

Its habits have been well described by Adams, Kinloch, and others. Owing to the protection afforded by its thick underfur, it is but little affected by cold, and "even during the winter ibex do not as a rule descend very low, but resort to places where, from the steepness of the hill-side, snow does not lie in any quantity. At this season males and females herd together, but as the snow melts and the time (May and June) for the birth of the young approaches, the old males forsake the females altogether, and, as the summer advances, retire to the most inaccessible mountains, frequently sleeping during the day above the limits of vegetation, and descending great distances to feed in the morning and evenings." (*Kinloch*). The males descend about October and mix with the herds, the rutting-season being in winter.

Kinloch also says:—"Although an excessively wary animal, the ibex is usually found on such broken ground that it is not very difficult to obtain a shot. The grand rule, as in all other hill-stalking, is to keep well above the herd, whose vigilance is chiefly directed beneath them. In places where they have been much disturbed, one or two of the herd usually keep a sharp look out while the others are feeding, and on the slightest suspicion of danger the sentries utter a loud whistle, which is a signal for a general rush to the nearest rocks."

The female has one or two young. Many of these animals are killed for the sake of obtaining the soft woolly underfur, which is woven into cloth, and used for lining articles of dress.

349. **Capra falconeri.** *The Markhor.*

Ægoceros (Capra) falconeri, *Hügel, Wagner, Münch. gel. Anz.* ix, p. 430 (1839).
Capra megaceros, *Hutton, Calc. Jour. N. H.* ii, p. 535, pl. xx (1842); *id. J. A. S. B.* xv, p. 161; *Blyth, Cat.* p. 176; *Jerdon, Mam.* p. 291.
Capra falconeri, *Hügel, Kaschmir*, iv, p. 579, pl.; *Blanford, J. A. S. B.* xliv. pt. 2, p. 17; *Scully, P. Z. S.* 1881, p. 209; *Sclater, P. Z. S.* 1886, p. 317; *W. Sclater, Cat.* p. 145.
Hircus megaceros, *Adams, P. Z. S.* 1858, p. 525.
Capra jerdoni, *Hume, P. A. S. B.* 1874, p. 240.

Márkhor (snake-eater), Afghanistan, Punjab, and S. Kashmir; *Ráche* (*Rápho-che* ♂, *Ráwa-che* ♀), Ladak; *Rezkuh, Matt*, ♂, *Hit, Haraf* ♀, Brahui; *Pachin, Sará*, ♂, *Buzkuhi* ♀, Baluch.

Beard in old males long and copious, extending from the chin down to the breast; in females and young males short, confined to the chin. Little or no underfur. Horns of males compressed, close together at the base, spirally wound, sharply angulate in young animals both in front and behind, more rounded in front at the base in old animals; the anterior keel turns outwards at first in each horn. In some the horns form an open spiral like that of a corkscrew, in others each horn is straight and conical, with the two keels winding round it, like the worm of a screw. Horns of females short, compressed, spiral.

Colour in summer rich reddish brown, in winter grey; hair of the body long, white at the base with brown tips, lower parts paler, sometimes whitish; carpus and tarsus with a dark stripe in front, tail dark brown. The young are greyish brown throughout, with a darker stripe down the back. Beard black in front, light grey behind, said in the young to be black throughout. Old males in summer look whitish throughout.

Dimensions. An old Gilgit male measured by Colonel Biddulph was 38·5 inches high, and 55 from between the horns to the root of the tail. Much longer dimensions are given by other writers. A skull measures 10 inches in basal length, 11·25 in extreme length, and 7·5 in orbital breadth. The length of the horns varies in different varieties.

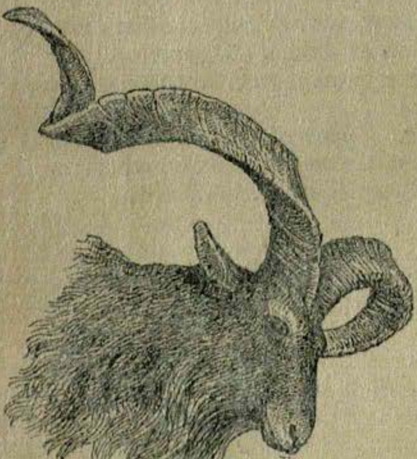

Fig. 164.—Head of *C. falconeri*, Astor var. (Copied from the figure of the type in Hügel's 'Kaschmir.')

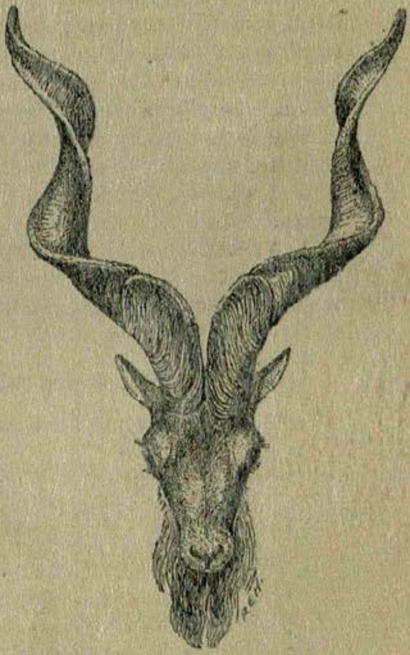

Fig. 165.—Head of *C. falconeri*, Pir Panjál var. (Copied from Kinloch's 'Large Game Shooting.')

Distribution. The Pir Panjál ranges south of Kashmir (not east of the Chenab) and the ranges of Baltistan, Astor, and Gilgit to the north. Hazára, and many of the hill ranges of Afghanistan, amongst others the Sulemán range as far south as Gendári Hill near Mithankot, also Takatu and Chehiltan near Quetta.

Varieties. Throughout the *Bovidæ* no species varies to so great an extent in the form of the horns as the markhor, and those who have seen but two or three varieties naturally regard them as belonging to distinct species. Four varieties are worthy of notice:—

1. The true *Capra falconeri* of Astor and Baltistan. (Fig. 164.)

This has massive horns forming a very open spiral, never exceeding 1½ turns.

2. The Pir Panjál markhor. (Fig. 165.) The spiral is less open. The horns have from 1 to 2 turns of the spiral in fine heads. This race extends, I believe, to Hazára and Gilgit, but it passes into the last and the next by every possible gradation. A horn of this or the first variety is said to have measured 63 inches round the curve (starting at back of horn) and 14·75 in girth at the base. Good horns measure 36 inches straight from base to tip, and 45 to 50 round the curve.

3. True *C. megaceros* of Hutton, from near Cabul. (Fig. 166.) Horns almost straight, but still having a slight spiral. Hutton had a horn of this that measured 42 inches straight from base to tip and 44 round the (? front) curve; horns of 60 inches are said to occur.

4. The Sulemán race, for which the name of *C. jerdoni* was proposed by Mr. Hume. (Fig. 167.) Many, perhaps most horns of this race are absolutely straight and conical, with the two keels, anterior and posterior, wound spirally round, the curve of the spiral much sharper than in other varieties, so that in good horns there are two or three complete turns. Other heads, however, show a complete passage into the Cabul form. The longest recorded horns of the

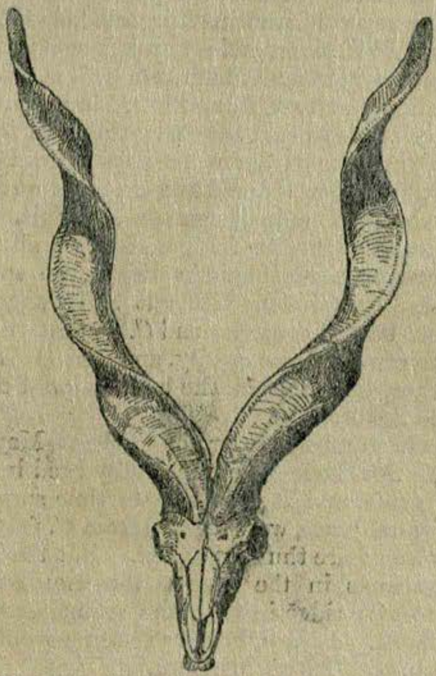

Fig. 166.—Head of *Capra falconeri*, Cabul var. (Copied from Hutton's figure of *C. megaceros.*)

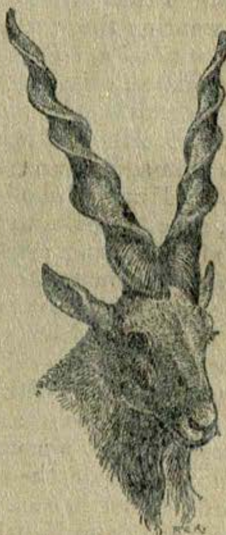

Fig. 167.—Head of *Capra falconeri*, Sulemán var. (*C. jerdoni*, Hume). (Copied from Kinloch's 'Large Game Shooting.')

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Sulemán markhor were 36 inches in length straight and 49 round the curve (beginning behind), girth at base 10·5; the main ridge made 3⅓ turns. This race is said to be considerably smaller than that of the Pir Panjál and to have a less developed beard. In the extreme south, however, near Quetta, the horns again assume an open spiral.

The accompanying figures (pp. 506, 507) show the variation in the horns, but it must not be forgotten that intermediate varieties occur. It is true that heads from one locality are, as a rule, similar to each other, but when a series from various places is examined it appears to me impossible to draw a line between the different types.

Habits. These vary with the character of the ground. Kinloch says:—"Unlike ibex, which keeps to the rugged crags and steep ravines above the limit of the forest, the markhor delights in rocky forests, and although it occasionally comes out into the open glades, it seeks concealment as much as possible." Like other goats it generally occurs in herds, and keeps much to steep rocky cliffs. In Afghanistan, where forest is, as a rule, wanting, the markhor is found in stony ravines and on steep hill-sides, and is found in some places at a low elevation. Wherever it inhabits high ranges it is usually driven to the valleys when heavy snow falls, and Col. Biddulph, who has noticed that the sensitiveness to cold shown by this goat is due to its wanting the woolly underfur or pashm, so greatly developed in *Capra sibirica*, tells me that he once found and captured an adult male markhor, driven down by snow, in his garden at Gilgit.

The markhor is in appearance by far the grandest of all wild goats, and although it attains a considerable weight, no species excels it in agility and skill in climbing difficult and dangerous ground. Hutton, who had both this species and *C. ægagrus* in captivity, gave the palm to the markhor for agility, and Mr. H. Littledale, after hunting markhor, remarked on the heavier build of the ibex which he met with in Astor.

The young, one or two in number, are produced about May and June in Astor and Gilgit. Markhor have repeatedly bred in confinement with domestic goats, and it was at one time supposed that the tame races with spiral horns were derived from *C. falconeri*. It is not improbable that some are thus descended. But the spiral in tame goats is almost always in the reverse direction to that found in markhor, the anterior ridge in the tame animals turning inwards at first in each horn. I have, however, seen exceptions; there is one from Nepal in the British Museum.

Genus **HEMITRAGUS**, Hodgson (1841).

A small muffle. Mammæ 4 or 2. No suborbital, inguinal, nor interdigital glands. No beard. Males odorous.

Skull long and narrow, orbits scarcely projecting. Occipital plane flat, meeting the frontal at a right angle or rather less. Horns close together at the base, small (rarely exceeding 15 or 16 inches), not very much larger in males than in females, commencing

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in the same plane as the forehead and curving backward, compressed, angulate in front. Otherwise as in *Capra*.

This genus is by many naturalists united to *Capra*, but appears fairly separable, the skull and horns differing greatly. The only two known species are Indian. Their habits are precisely those of goats.

Synopsis of Indian Species.

Horns flattened externally. Mammæ 4........	*H. jemlaicus*, p. 509.
Horns convex externally. Mammæ 2..........	*H. hylocrius*, p. 511.

A fossil species, *H. sivalensis*, has been found in the Pliocene of the Siwaliks.

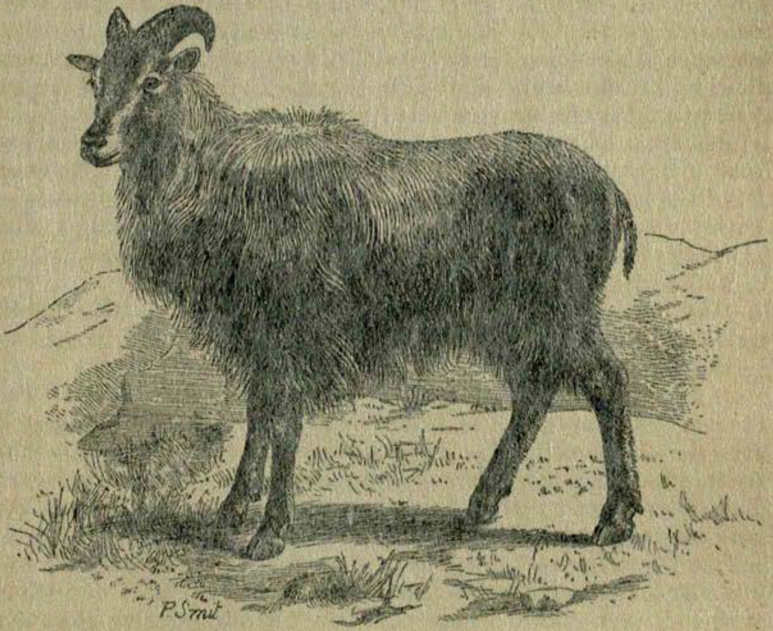

Fig. 168.—*Hemitragus jemlaicus.*

350. **Hemitragus jemlaicus.** *The Tehr or Tahr.*

Capra jemlahica, *Ham. Smith, Griffith's An. King.* iv, p. 308, pl. (1827); *Sclater, P. Z. S.* 1886, p. 317; *W. Sclater, Cat.* p. 146.
Capra jharal, *Hodgson, As. Res.* xviii, pt. 2, p. 129, pl. (1833); *id. P. Z. S.* 1834, p. 106; *id. J. A. S. B.* iv, p. 491.
Capra quadrimammis, *Hodgson, J. A. S. B.* iv, p. 710; v, p. 254.
Hemitragus quadrimammis *vel* jharal, *Hodgson, J. A. S. B.* x, p. 913.
Hemitragus jemlaicus, *Adams, P. Z. S.* 1858, p. 523; *Blyth, Cat.* p. 175; *Jerdon, Mam.* p. 286; *Blanford, J. A. S. B.* xli, pt. 2, p. 40; *Lydekker, J. A. S. B.* xlvi, p. 286.

Tehr, Jehr, Western Himalayas; *Krás, Jagla*, Kashmiri; *Jhula* ♂, *Tahrni* ♀, Kunáwar; *Esbu*, Sutlej above Chini; *Kart*, Kulu, Chamba, &c.; *Jharál*, Nepal.

Hair on head short, on body longer, and on the neck, shoulders, and breast so long in old males as to form a shaggy mane reaching to below the knees. Tail short, depressed, nude below; knees and breast callous. Four mammæ.

Head long, face narrow and straight; nasals narrow. Horns almost touching or touching at the base, slightly wrinkled transversely, greatly compressed, flattened on each side, more rounded but still slightly flattened towards the base behind, strongly compressed and furnished with a distinct nodose keel in front, diverging from the base, curved sharply backwards, converging again a little at the tips.

Colour rich dark brown or reddish brown, old males much darker; the fur pale at the base, dark brown towards the ends. There is considerable variation in colour, some individuals of both sexes being very pale. The face and the front of all the limbs very dark, almost black in some; a dark band, indistinct in old males, down the back. The backs of the limbs pale or rusty red in males. Young animals are greyish brown; kids are said to be very pale.

Dimensions. Height of a male at shoulder 36 to 40 inches, nose to root of tail 4 ft. 8 in., tail without hair 3·25, with hair 7. Extreme length of skull 10·75, orbital breadth 5·4. Horns 12 to 15 inches long outside the curve; extreme measurement recorded 16·5, with a basal girth of 11·5. Females are much smaller, and the horns seldom exceed 10 inches in length.

Distribution. Throughout the Himalayas from the Pir Panjál to Sikhim (I have skins from the latter, obtained by Mr. Mandelli), in the higher forests.

Habits. Col. Kinloch's account is excellent. He says:—"The tahr is, like the markhor, a forest-loving animal, and although it sometimes resorts to the rocky summits of the hills, it generally prefers the steep slopes which are more or less clothed with trees. Female tahr may be frequently found on open ground; but old males hide a great deal in the thickest jungle. Nearly perpendicular hills with dangerous precipices, where the forest consists of oak and ringal cane, are the favourite haunts of the old tahr, who climb with ease over ground where one would hardly imagine that any animal would find a footing." He adds that tahr and markhor are found together on the Pir Panjál.

Like the true goats, tahr associate in herds, the males and females at times keeping apart. They rut in winter, and the females produce one kid as a rule in June or July, the period of gestation, according to Hodgson, being six months. But it is necessary to point out that Hodgson's information about this animal's habits was chiefly derived from his collectors and was not always correct. He, however, kept some individuals tame with a flock of tame goats, but, although they had free intercourse, no offspring was produced. He also states that in Nepal a hybrid was born between a male tahr and a female spotted deer, but the story must, I think, be erroneous.

The flesh of the female tahr is excellent, but that of old males is too rank for European tastes, though much relished by particular classes of natives.

351. **Hemitragus hylocrius.** *The Nilgiri wild Goat.*

Kemas hylocrius, *Ogilby, P. Z. S.* 1837, p. 81.
Capra (Ibex) warryato, *Gray, A. M. N. H.* x, p. 267 (1842).
Hemitragus hylocrius, *Blyth, J. A. S. B.* xxviii, p. 291; *id. Cat.* p. 175; *Jerdon, Mam.* p. 288.
Capra hylocrius, *Sclater, P. Z. S.* 1886, p. 318; *W. Sclater, Cat.* p. 146.

Warri-ádú, Warri-átú, Tam.; *Kard-ardu*, Can.; *Mulla-átú*, Mal.; *Ibex* of European sportsmen.

Hair short, thick, and coarse. A short stiff mane in males on the ridge of the neck and withers. Knees callous. The face slightly concave at the end of the frontals, nasals a little convex in front. Horns almost touching at the base and subparallel for some distance, then curved back and diverging slowly; they are transversely wrinkled, flat inside, convex outside, rounded behind, with a low compressed keel inside at the front. Mammæ two.

Colour dark yellowish brown, with a greyish tinge in females and young; a dark band down the back; lower parts paler. Old males are dark sepia-brown, almost black on the face and limbs; a broad band on each side of the face, and an area behind the eye grizzled and paler, fawn-coloured around the eye; a large area in the lumbar region and the legs grizzled white, the latter dark brown in front, paler behind. The lumbar tract is almost white in very old animals, and from its being conspicuous at a distance adult males are known as "saddlebacks."

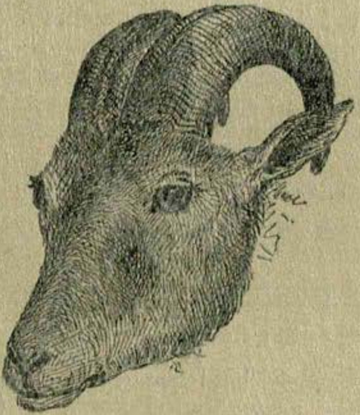

Fig. 169.—Head of *H. hylocrius**.

Dimensions. According to Col. Douglas Hamilton old males measure from 39 to 42 inches at the shoulder, nose to tail (straight) 50½, tail 3. Females measure up to 35 inches at the shoulder.

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* I am indebted to Mr. R. A. Sterndale for making and sending to me the drawing from which this cut is taken.

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Horns of males are 12 to 16 inches long round the curve; the largest recorded was 17 long and 9¾ in girth. Female horns are found 11 inches long and perhaps longer. Basal length of a male skull 9·7, extreme length 10·9, orbital breadth 4·9.

Distribution. Nilgiri and Anaimalai hills, in Southern India, and the Western Ghats from the Anaimalais to the neighbourhood of Cape Comorin, chiefly at elevations of 4000–6000 feet, but occasionally in suitable places at lower levels.

Habits. The haunts of the present species are similar to those of the tahr and of the true goats, but much more tropical. With the exception of an ibex on the higher mountains of Abyssinia, this is the only goat living south of the north temperate zone. The Nilgiri goat is found usually in herds of from 5 or 6 to 50 or 60 amongst the crags and rocky precipices that border the Nilgiris and other high ranges in the extreme south of India. It keeps above the forest and but rarely enters woods. I have more than once seen these animals feeding on the grassy hills at the top of the Kundahs west of the Nilgiris, but their usual haunts are the grassy slopes and precipitous crags on the edges of the plateau; they feed on the former in the mornings and evenings, and rest on ledges amongst the cliffs during the day. They are quite as wary and sharp-sighted as tahr or markhor, and just as nimble and alert on precipitous ground. An old doe, as with other goats, usually acts as sentinel to the herd, and they always appear to suspect danger from below and not from above. Many are killed by leopards, a few by tigers, and probably some by wild dogs.

The old male has the usual strong odour of goats, and his flesh is rank and unpalatable; that of does and young males is excellent. The breeding-season appears to extend throughout a great part of the year, kids being found with the herds, according to Col. Douglas Hamilton, in most months. The female is said to produce two young at a birth.

Genus **NEMORHÆDUS**, Ham. Smith (1827).

Syn. *Capricornis*, Ogilby (1836).

Tail short, hairy. Suborbital glands present, and opening by a small circular orifice; a large but shallow lachrymal fossa. Interdigital glands on all feet. No inguinal glands. A naked muffle. Mammæ 4.

Facial and parietal regions of skull not separated by an angle, but slightly rounded; occipital plane forming an obtuse angle with the parietal region. Orbits not projecting, the zygomatic arches wider than the orbits. Nasals more or less truncated behind, articulating with the maxillaries for a long distance. Horns in both sexes scarcely differing in size, short, conical, closely ringed, the rings small, rather irregular, and broken by longitudinal striæ. The direction of the horns is at first nearly continuous with the facial plane, then slightly curved backwards.

This genus is peculiar to South-eastern and Eastern Asia. Two species occur within Indian limits. The others are *N. swinhoei* from Formosa, and *N. crispus* from Japan, both small, about the size of the goral.

Synopsis of Indian and Burmese Species.

Legs white or grey near the feet	*N. bubalinus*, p. 513.
Legs rufous	*N. sumatrensis*, p. 514.

352. **Nemorhædus bubalinus.** *The Himalayan Goat-antelope or Serow.*

Antilope bubalina, *Hodgson, P. Z. S.* 1832, p. 12; *id. Gleanings Sc.* iii, p. 122.
Antilope thar, *Hodgson, Gleanings Sc.* iii, p. 324 (1832); *id. P. Z. S.* 1833, p. 105, 1834, p. 86; *id. J. A. S. B.* iv, p. 489.
Capricornis thar, *Ogilby, P. Z. S.* 1836, p. 139.
Nemorhædus proclivus *vel* thar, *Hodgson, J. A. S. B.* x, p. 913 (1841).
Capricornis bubalina, *Adams, P. Z. S.* 1858, p. 522; *Blyth, Cat.* p. 174.
Nemorhœdus bubalina, *Jerdon, Mam.* p. 283; *Blanford, J. A. S. B.* xli, pt. 2, p. 40; *Anderson, An. Zool. Res.* p. 335.
Nemorhædus bubalinus, *W. Sclater, Cat.* p. 149.

Saráo, N.W. Himalayas; *Rámu, Halj, Sálábhir*, Kashmir; *Goa*, Chamba; *Aimu*, Kunáwar; *Yamu*, Kulu; *Thar*, Nepal; *Gya*, Bhotia of Sikhim; *Sichi*, Lepcha.

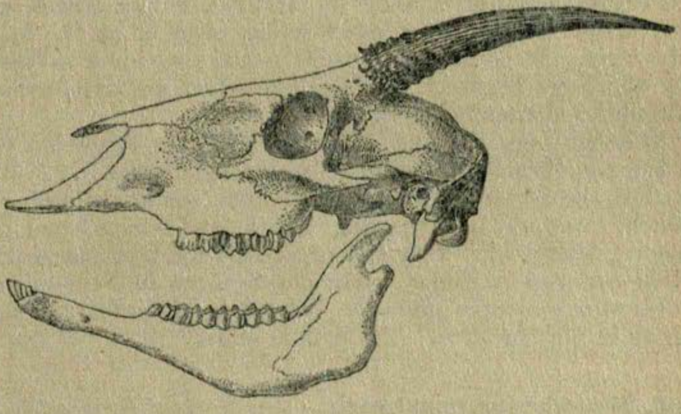

Fig. 170.—Skull and horns of *Nemorhædus bubalinus*.

Form heavy, head large. Ears large. Hair coarse, rather thin, of moderate length; a crest of rather longer hair from the nape to the withers; no underfur.

Colour black or dark grey above, somewhat grizzled owing to the hair being whitish at the base; head and neck black. The black passes into rusty red on the sides, buttocks, thighs, forearms, chest, and throat; abdomen, inside of thighs, and lower part of all

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legs dirty white; inside of ears, chin in front and at the sides, also white. A black line down the back cannot always be distinguished. Horns black.

Dimensions. An adult male measured: height at shoulder 37 inches, length of head 11½, horns to root of tail 49, tail with hair 6½, without 3¼, total length 67, ear 7¾, girth of body 38 (*Hodgson*). Basal length of skull 10·5, zygomatic breadth 4·9; horns in male 9 to 10 long, 5 to 6 in girth, maximum recorded 13·5 and 6·5 in males, 8·75 and 4·75 in females. Weight over 200 lb.

Distribution. Throughout the Himalayas from Kashmir to the Mishmi hills at elevations between 6000 and 12,000 feet. Also obtained by Anderson in Yunnan.

Strictly, the specific name *thar* has priority over *bubalinus*, having been published earlier in 1832 (in the first notice of the "bubaline antelope" published in the 'Gleanings in Science' no Latin name was given), but as the term *thar* or *tahr* is commonly applied to *Hemitragus jemlaicus* its employment for the serow would lead to confusion. The use of native names for animals is generally to be avoided; thus the term Saráo or Sará, used in parts of the Himalayas for the present species, is applied in the Suliman range to *Capra falconeri* and in Sind to *C. ægagrus*, whilst in the Sutlej valley it is used for the goral.

Habits. Kinloch says:—"The serow has an awkward gait, but in spite of this it can go over the worst ground, and it has, probably, no superior in going down steep hills. It is a solitary animal, and is nowhere numerous." It is generally found in thick forest, but often on rocky hill-sides, and "its favourite resting places are in caves, under the shelter of overhanging rocks or at the foot of shady trees. It constantly repairs to the same spot, as testified to by the large heaps of its droppings which are to be found in the localities above alluded to."

"Although very shy and difficult to find, the serow is a fierce and dangerous brute when wounded and brought to bay" . . ." When disturbed the serow utters a most singular sound, something between a snort and a screaming whistle, and I have heard them screaming loudly when they had apparently not been alarmed."

Hodgson says a single young one is born in September or October after 8 months' gestation, but Adams states that the young are born in May or June. The flesh is coarse.

353. **Nemorhædus sumatrensis.** *The Burmese Goat-antelope.*

Antilope sumatrensis, *Shaw, Gen. Zool.* ii, pt. 2, p. 354 (1801); *Raffles, Tr. L. S.* xiii, p. 266.
Antilope (Nemorhædus) sumatrensis, *Ham. Smith, Griffith's An. King.* iv, p. 277 (1827).
Nemorhædus sumatrensis, *Cantor, J. A. S. B.* xv, p. 272; *Beavan, P. Z. S.* 1866, p. 4; *W. Sclater, Cat.* p. 150.
Capricornis sumatrensis, *Gray, P. Z. S.* 1850, p. 135; *Blyth, Cat.* p. 174; *id. Mam. Birds Burma*, p. 46; *Bock, P. Z. S.* 1879, p. 308.
Capricornis rubida, *Blyth, Cat.* p. 174.

GSL

Capricornis milne-edwardsii, *David, Nouv. Arch. Mus.* v, p. 10 (1869).
Antilope (Nemorhædus) edwardsii, *M.-Edw. Rech. Mam.* p. 364, pls. lxxii, lxxiii.
Nemorhedus edwardsii, *Anderson, An. Zool. Res.* p. 335.

Tau-tshick, Burmese (*Tau-myin* in Pegu); *Kambing-útan*, Malay.

This appears only to differ from *N. bubalinus* in being more rufous. The present species is said to be smaller, but there is very little, if any, difference in size.

Colour varying from rufous-brown to black, the black sometimes with a white nape. A black dorsal stripe in brown examples. Legs always rufous from the thigh and forearm downwards.

Dimensions. An adult female from near Moulmein measured in height at the shoulder $34\frac{1}{2}$ inches, from nose to root of tail 49, tail without hairs 5, with hair 7, girth of body 34, ear $8\frac{3}{4}$ (*Beavan*). Basal length of a large female skull 10·5, extreme length 11·25, zygomatic breadth 4·9. Horns 8 to 9·5 long.

Distribution. From the Eastern Himalayas, Moupin, and Yunnan to Sumatra, throughout the Assam Hills, Burma, Siam, and the Malay Peninsula, on hills. An animal intermediate in colour between *N. sumatrensis* and *N. bubalinus* was killed by Col. Kinloch near Darjiling, whilst *N. bubalinus* inhabits the interior of Sikhim.

I am far from satisfied that this goat-antelope and *N. bubalinus* are really distinct, or, if they are, whether the Arakan *N. rubidus* belongs to the present form. I follow Blyth in uniting *N. rubidus* and *N. sumatrensis*, but *N. swinhoei* from Formosa, also united by Blyth, is a perfectly distinct species. The habits of *N. sumatrensis* resemble those of *N. bubalinus*, but the former inhabits less elevated ground.

A very remarkable animal, *Budorcas taxicolor*, the *Takin* of the Mishmis, is found on ranges within sight of Upper Assam, but not within our limits. It has been well described by Hodgson (J. A. S. B. xix, p. 65, pls. i–iii; see also M.-Edw. Rech. Mam. p. 367, pls. lxxiv–lxxix, and Hume, P. Z. S. 1887, p. 483). It is a heavily-made animal, much larger than a Serow, with stout limbs, large hoofs to the lateral digits, a short tail like a goat's, a large head, convex profile, and thick horns in both sexes, arising close together in males and curving outwards at first, then making a sharp turn and pointing backwards; whilst in females, according to Hume, the horns arise further apart and curve outwards and then backwards without any sharp twist. According to other writers, female horns resemble those of males in shape, but are smaller. Colour of the body varying from yellow dun to deep reddish brown mixed with black; head always black. Length from snout to vent $6\frac{1}{2}$ feet, height at shoulder $3\frac{1}{2}$, tail 3 inches long; skull 18 long and $7\frac{3}{4}$ wide, horns 20 to 24 long in males, 12 in females, girth of each 9 to 10. *Budorcas* is found in herds or singly at high elevations in the Mishmi hills and Eastern Tibet, and is probably one of the peculiar Tibetan types like *Pantholops*; it is evidently, like *Nemorhædus*, allied to both goats and antelopes; I can not see the bovine affinities attributed to it.

GSL

Genus **CEMAS**, Ogilby (1836).

Syn. *Kemas*, Ogilby; *Nemorhædus*, auct., nec H. Smith; *Urotragus*, Gray.

No suborbital glands nor lachrymal fossæ. Interdigital glands present. No inguinal glands. A naked muffle. Mammæ 4.

The parietal and facial regions of the skull meet at an obtuse angle. Orbits somewhat more prominent than in *Nemorhædus*. Nasals very short, pointed or convex behind, separated by a fissure from the maxillaries. Horns short, of nearly equal size in the two sexes, conical, curved backwards, ringed closely except at the tip, the rings rather irregular and wavy, slightly broken up by longitudinal striæ.

This genus has generally been united to *Nemorhædus*, but I think Ogilby, Hodgson, and Gray were right in separating it, the shape of the skull being very different. The species are Palæarctic, and range from the Himalayas to North China. Only one is found within Indian limits; the others are *C. cinerea* and *C. grisea* from E. Tibet, and *C. caudata* from Northern China.

354. **Cemas goral.** *The Goral.*

Antilope goral, *Hardwicke, Tr. L. S.* xiv, p. 518, pl. xiv (1825).
Antilope (Nemorhedus) goral, *Hodgson, P. Z. S.* 1834, p. 85; *id. J. A. S. B.* iv, p. 488.
Kemas ghoral, *Ogilby, P. Z. S.* 1836, p. 138; *Hodgson, J. A. S. B.* xvi, p. 697.
Nemorhedus goral, *Horsfield, Cat.* p. 168; *Adams, P. Z. S.* 1858, p. 523; *Blyth, Cat.* p. 175; *Jerdon, Mam.* p. 285; *Blanford, J. A. S. B.* xli, pt. 2, p. 40; *Butler, J. A. S. B.* xliv, pt. 1, p. 332; *Lydekker, J. A. S. B.* xlvi, pt. 2, p. 286; *W. Sclater, Cat.* p. 148.

Goral, N.W. Himalaya; *Pij*, *Pijur*, *Rai*, *Rom*, Kashmir; *Sáh*, *Sár*, Sutlej Valley; *Suh-ging*, Lepcha; *Ra-giyu*, Sikhim Bhotia; *Deo Chágal*, Assam.

Form goat-like. Limbs stout. Horns subparallel, scarcely diverging. Hair rather coarse, with a little woolly underfur; a very small crest of longer hair on the back of the neck and around the horns.

Colour brown, more or less rufous or greyish, but little paler below. Face paler and rufescent, darker near the horns. A black line down the back from the nape to the tail, which is also black, a dark line down the front of each leg, remainder of carpus and tarsus rufous brown. Throat white. Horns black.

Dimensions. Height at shoulder 27 inches, length exclusive of tail 50 (*Hodgson*); tail 4 according to Jerdon. Extreme length of skull 8·25, breadth across orbits 3·85. Horns of males 6 to 8 inches long, of females less; maximum length and girth recorded in males 9·75 and 4, in females 7·75 and 2·5.

Distribution. Himalayas, at moderate elevations between 3000 and 8000 feet, from Kashmir to Bhutan. Not common in the Siwálik hills according to Kinloch. According to Captain Butler this species in found in the Nága hills, south of Upper Assam.

Habits. It is difficult to improve upon Jerdon's account. He says the goral "usually associates in small parties of from four to eight or so, and frequents rugged grassy hills or rocky ground in the midst of forest. If one goral is seen, you may be pretty certain that others are not far off, and they rarely or never forsake their own grounds. If cloudy they feed at all hours, otherwise only morning and evening. When one is alarmed it gives a hissing snort, which is answered by all within hearing." The few I have seen were in pairs, but this may have been due to the time of year—September. Old males, according to Kinloch, are generally solitary.

According to Hodgson the period of gestation is six months, and the young, usually single, is born in May or June. The goral is one of the best known Himalayan animals; it cares but little for the neighbourhood of man, and is frequently found near hill-stations.

Genus **BOSELAPHUS**, Blainville (1816).

Syn. *Portax*, H. Smith (1827).

Tail long and tufted. Hind limbs shorter than fore, withers very high. Suborbital gland small; no lachrymal fossa. Interdigital glands present. No inguinal glands. Muffle large, bovine. A mane on the back of the neck in both sexes, and a tuft of hair on the throat of the male.

Frontals and parietals almost in one plane, forming a right angle with the occipital. Molars very hypsodont, a large accessory column in those of the upper jaw. Females hornless; horns in males arising a little distance apart, just behind the orbit; they are short, smooth, pointed, directed upwards and backwards, nearly straight, subconical above, triangular at the base, with the posterior side flat, and a ridge in front, which in old animals runs forwards and inwards at the base till the horns almost touch.

This is the only surviving genus in Asia of the Tragelaphine antelopes, comprising eland, kudu, &c. There is but a single living species, peculiar to India. A closely allied fossil form, *B. namadicus*, occurs in Indian Pleistocene and Pliocene beds.

355. **Boselaphus tragocamelus.** *The Nilgai or blue bull.*

Antilope tragocamelus, *Pallas, Spic. Zool.* i, p. 9 (1767), xii, p. 13.
Antilope picta, *Pallas, Spic. Zool.* xii, p. 14 (1777); *Sykes, P. Z. S.* 1831, p. 105.
Damalis risia, *H. Smith, Griffith's An. King.* iv, p. 363 (1827); *Elliot, Mad. Jour. L. S.* x, p. 226.

Portax tragocamelus, *Adams, P. Z. S.* 1858, p. 523; *Blyth, Cat.* p. 165.
Portax picta, *Horsfield, Cat.* p. 170; *Jerdon, Mam.* p. 272.
Boselaphus tragocamelus, *W. Sclater, Cat.* p. 154.

Nil, Nilgao ♂, *Nilgai* ♀, *Rojh, Roz, Rojra*, H.; *Rú-i*, Dakhani, Mahr., Guzr., &c.; *Gúraya*, Gond; *Murim* ♂, *Susam* ♀, Ho Kol; *Mánú-potú*, Tam.; *Mairu, Maravi, Kard-kadrai*, Can.

General form somewhat equine; neck deep and compressed. Tail reaching hocks.

Colour of adult male dark grey, varying from bluish to brownish grey throughout, except the mane, throat tuft, terminal half of the ear outside and two spots inside, and the tip of the tail, which are black, and a patch on the throat, two spots on each cheek, the lips, chin, inside of the ears, except the two black spots, the lower surface of the tail, the abdomen, and a ring above and another below each fetlock, which are white. Females and young males brown. Horns black.

Dimensions. Male usually 52 to 56 inches (13 to 14 hands) high at the shoulder, but 58 inches is said by McMaster to have been measured; length from nose to rump 6½ to 7 feet, tail 18 to 21 inches, ear 7. Basal length of a male skull 15·3; orbital breadth 5·85. Females considerably smaller. Horns are usually 8 to 9 inches long and 8 in girth at the base, maximum recorded measurements 11·75 and 9·5.

Distribution. The Peninsula of India from the base of the Himalayas to the south of Mysore; not in Ceylon, nor, I believe, near the Malabar coast in the Madras Presidency, although the nilgai inhabits the Konkan near Bombay. It is common in parts of the Eastern Punjab, the North-west Provinces, Guzerat and the Central Provinces, rarer to the southward. It is not found in Eastern Bengal, Assam, nor anywhere east of the Bay of Bengal, nor does it range to the Indus on the west.

Habits. Thin bush with scattered low trees or alternations of scrub and open grassy plains are the usual haunts of this animal; it is found either on level or undulating ground or on hills. It is rarely met with in thick forest, though it may often be found on cultivated plains, where it does much damage to crops.

Males are often solitary, but they occasionally associate in herds, and I have seen as many as a dozen old blue bulls together. Females and young, sometimes accompanied by one or more old males, are found usually in small parties of from four to ten, though sometimes in herds of 15 to 20 or more. Nilgai feed a good deal throughout the day, and care but little for sun, though they lie down at times in shade. They both graze and browse, feeding on the leaves of ber (*Zizyphus*) and other trees, and, according to Sterndale, they devour quantities of the acrid fruits of aonla (*Phyllanthus*). He also says that they drink daily, but this does not correspond with my observations. So far as I could ascertain, in the cold season they only drink at intervals of two or three days. They keep much to the same ground, and their haunts may

GSL

be recognized by their droppings, which they are in the habit of repeatedly depositing in the same spot, until considerable accumulations are formed.

The pace of the nilgai when alarmed is a heavy gallop. It requires a good horse to catch the bull, which has, however, been not unfrequently run down and speared, but he must be pressed at first. The cow, Kinloch says, cannot be run down by a single rider, and I never heard of one being speared. Few sportsmen care about shooting nilgai, and in some places they become very tame, as they are generally protected by Hindus, who regard them as a kind of cow.

Nilgai are easily tamed, but the males are sometimes savage in confinement. Tame individuals have been taught to draw light carriages, and Sterndale relates that he trained one to carry a load and to be ridden. They have bred in confinement in Europe, and the period of gestation was found in the Regent's Park Zoological Gardens to be between 8 and 9 months (P. Z. S. 1863, p. 230). One or very often two young are produced. The flesh of the nilgai is fairly good, though inferior to that of most Indian wild *Bovidæ*.

Genus **TETRACERUS**, Leach (1825).

Size small. A muffle present. An elongate suborbital gland; interdigital glands confined to the hind feet. No inguinal glands. Hoofs small, rounded in front. Tail short. Mammæ 4.

Frontal and parietal profile of skull slightly and gently rounded, the occipital meeting the parietal at a right angle. Lachrymal fossa large. Horns in the male only, usually 4 in number in adults; all the horns short, conical, smooth, the posterior pair much longer than the anterior, which are situated between the orbits, are often mere knobs and are not unfrequently wanting. Jerdon's statement that there are canines in the males is a mistake.

There is a single species peculiar to India. This is the only Indian representative of the Cephalophine antelopes of Africa or Duikerboks. Remains of *T. quadricornis* are found fossil in the Pleistocene cave-deposits of Kurnool, and a small Siwalik ruminant is referred to this genus.

356. **Tetracerus quadricornis.** *The four-horned Antelope.*

Antilope (Cervicapra) quadricornis, *Blainville, Bull. Soc. Philom.* 1816, p. 78.

Antilope chickara, *Hardwicke, Tr. L. S.* xiv, p. 530, pls. xv, xvi (1825); *Hodgson, J. A. S. B.* i, p. 346.

Antilope sub-4-cornutus, *Elliot, Mad. Jour. L. S.* x, p. 225, pl. iv, fig. 2 (1839).

Tetraceros chickera, *Blyth, J. A. S. B.* xi, p. 451.

Tetracerus quadricornis, *Gray, List Mam. B. M.* p. 159; *Blyth, J. A. S. B.* xvi, p. 879, xvii, p. 561; *id. Cat.* p. 165; *Horsfield, Cat.* p. 167; *Adams, P. Z. S.* 1858, p. 522; *Jerdon, Mam.* p. 274; *Blanford, J. A. S. B.* xxxvi, p. 196; *W. Sclater, Cat.* p. 168.

Tetracerus chickara, quadricornis, subquadricornutus, iodes, *and* paccerois, *Hodgson, Calc. Jour. N. H.* viii, pp. 89, 90 (1847); *id. J. A. S. B.* xvi, p. 695.

Tetracerus subquadricornutus, *Gray, P. Z. S.* 1850, p. 117; *Sclater, P. Z. S.* 1875, p. 527.

Chousingha, Chouka, Doda, H.; *Benkra,* Mahr.; *Bhokra, Phokra,* Guzr.; *Bhirki,* at Saugor; *Bhir,* Gond; *Bhirul,* Bheel: *Kotari,* Chutia Nágpur; *Kurus,* Gonds of Bastar; *Konda-gori,* Tel, ; *Kondguri, Kaulla-kuri,* Can.: commonly in the Deccan *Jangli bakri.*

Fur thin, harsh, and short. Tail above with longer hair than on the body.

Colour dull pale brown, with a more or less rufous tinge above, passing gradually on the sides and limbs into the white of the lower parts. A dark stripe down the front of each leg, broadest on the fore limbs; muzzle and ears outside also dark. A dark stripe down the back in some specimens, probably young.

Dimensions. Height of a male at shoulder 25½ inches, at croup 27; length from muzzle to rump 42, tail (? without hair) 5, ear 4¼. Weight 43 lb. Females are rather smaller. Basal length of a large male skull 6·5, orbital breadth 3·2. The posterior horns are usually 3 to 4 inches long, the anterior 1 to 1½; maximum recorded lengths 4·5 and 2·5.

Distribution. Along the base of the Himalayas from the Punjab to Nepal, and probably in most parts of the Peninsula where the country is wooded and hilly, but not in dense jungle. The four-horned antelope is not found in the Gangetic plain nor on the Malabar coast in the Madras Presidency. It is said by Mr. Murray to be found in Sind; it is common in the wooded parts of Rajputana, throughout the Bombay Presidency, the Central Provinces, and the northern parts of Madras, less abundant to the eastward in Chhattisgarh, Chutia Nagpur, Bengal, and Orissa, and to the southward in Mysore, but it occurs in the latter State occasionally, and has been observed on the Nilgiri and Palni hills. It is unknown in Ceylon and east of the Bay of Bengal. In jungle this species and hog-deer (*Cervus porcinus*) may easily be mistaken the one for the other, and some recorded localities of the latter may be due to this circumstance.

Varieties. In the Madras Presidency the anterior horns are said to be but rarely developed, and certainly fully adult animals occur without any, and with only small projections on the skull. But I can see no other difference; the skulls, whether the anterior horns are developed or not, are precisely similar in form and scarcely differ in size. In the case of a male that I obtained young in Nimar and that was kept alive by a friend in Bombay, the anterior horns did not appear till the third year, although the posterior horns were well developed early in the second. Doubtless many of the two-horned individuals seen are young. Blyth (J. A. S. B. xvii, p. 560) came to the conclusion that the two-horned form is merely a variety; and after reading all that has been written by McMaster and Sterndale on the subject, I agree with him.

Habits. This species differs from all other Indian antelopes in habits as much as in structure. It is not gregarious, very rarely are more than two seen together; it haunts thin forest and bush, and keeps chiefly to undulating or hilly ground. It drinks daily, and is never seen far from water. It is a shy animal, and moves with a peculiar jerky action, whether walking or running. The rutting-season is in the rains, and the young, one or two in number, are born about January or February, the period of gestation being, according to Hodgson, six months. The placentation has been described by Mr. Weldon (P. Z. S. 1884, p. 2). The present species, according to Elliot, has the habit of depositing its dung repeatedly in one spot. This does not agree with my experience.

The name *Chinkara* has been applied to this animal in error. The flesh is said to be dry, but I have often eaten it and found it better than that of most Indian deer, though not equal to antelope or gazelle. When taken young this antelope is easily tamed.

Genus **ANTILOPE**, Pallas (1767).

Size moderate. Tail short, compressed. Large suborbital glands with a linear opening. Interdigital glands large in all feet. Inguinal glands large. No muffle, Mammæ 2. Hoofs pointed. A tuft of long hair on each knee (carpus).

Skull with prominent orbits; the frontal profile rounded off into the parietal, which meets the occipital at an obtuse angle. Supraorbital foramina of frontals large, a small lachrymal fissure and large lachrymal fossa. Horns in the male only, arising near together, cylindrical, spiral, diverging, ringed throughout, the rings subdistant, closer together near the skull, blunt, extending all round the horns.

A single species peculiar to India. The horn-cores are found fossil in the Pleistocene Jumna beds.

357. **Antilope cervicapra.** *The Indian Antelope or black Buck.*

Capra cervicapra, *L. Syst. Nat.* i, p. 96 (1766).
Antilope cervicapra, *Pallas, Spic. Zool.* i, p. 19, pls. i, ii (1767); *Gray & Hardw. Ill. Ind. Zool.* i, pls. xii, xiii; *Bennett, P. Z. S.* 1836, p. 34; *Elliot, Mad. Jour. L. S.* x, p. 222; *Hutton, J. A. S. B.* xv, p. 150; *Blanford, J. A. S. B.* xliv, pt. 2, p. 18; *Ball, P. A. S. B.* 1877, p. 171; *W. Sclater, Cat.* p. 162.
Antilope bezoartica, *Gray, P. Z. S.* 1850, p. 117; *Blyth, Cat.* p. 171; *Jerdon, Mam.* p. 275; *Blanford, J. A. S. B.* xxxvi, pt. 2, p. 196; *Stoliczka, J. A. S. B.* xli, pt. 2, p. 229.

Ena ♂, *Harina*, *Mirga*, Sanscr.; *Haran*, *Harna* ♂, *Harni* ♀, *Kalwit* ♀, *Mrig*, H.; *Kala* ♂, *Goria* ♀, Tirhoot; *Kálsar* ♂, *Baoti* ♀, Behar; *Bureta*, Bhágalpur; *Báránt*, *Sásin*, Nepal; *Alali* ♂, *Gandoli* ♀, Baori; *Bádú*, Ho Kol; *Bámani-haran*, Uria and Mahr.; *Phandayat*, Mahr.; *Kutsar*, Korku; *Veli-man*, Tam.; *Irri* ♂, *Ledi*, *Jinka*, Tel.; *Chigri*, *Húlé-kara*, Can.

The horns vary in divergence and in closeness of spiral; in some the points are not more than 7 inches apart, in others as much as 20, irrespective of length; the turns of the spiral in adults vary from less than 3 to 5. Horned females are occasionally, but very rarely, met with; I once saw one, near Nágpur. In these the horns curve back, more or less, from the head.

Colour of does and young bucks yellowish-fawn above and on the outside of the limbs, lower parts white, the two colours sharply divided; a distinct pale lateral band a little above the line of division. Old bucks are blackish brown above, becoming almost black in very old animals, except on the nape, which remains brownish rufous, whilst the sides and front of the neck, and also the face except a white area round each eye, are blackish brown. The pale lateral band disappears in old males.

Dimensions. Height at shoulder about 32 inches; length of head and body 4 feet, tail 7 inches, weight about 90 lb. Basal length of a male skull 8·6; breadth across orbits 4·1. Horns of adults are usually 16 to 20 inches long, measured in front straight from base to tip; in the Peninsula they rarely exceed 22 inches. The longest horns are met with in Rajputana and Hurriana, where 28·75 inches has been recorded. Largest observed girth at base 6·25.

Distribution. India from the base of the Himalayas to the neighbourhood of Cape Comorin (the southernmost locality known to me is Point Calimere), and from the Punjab to Lower Assam, in open plains, not in Ceylon nor east of the Bay of Bengal. Not found on hills nor in thickly wooded tracts, and wanting throughout the Malabar coast south of the neighbourhood of Surat. The statement that this antelope is not found in Lower Bengal is not quite correct; none are found in the swampy Gangetic delta, but many exist on the plains near the coast in Midnapore (I have shot them near Contai), as they also do in Orissa. Antelopes are most abundant in the North-west Provinces, Rajputana, and parts of the Deccan, but are locally distributed and keep to particular tracts.

Habits. Open plains of short grass, level or undulating, and cultivated land are the usual haunts of the Indian antelope, which is generally found in herds; these are sometimes extremely numerous, and comprise occasionally several thousand animals of both sexes and all ages; but more often small herds of does, generally 10 to 30 in number, but sometimes as many as 50, are met with, attended by a single black buck, which does not always accompany the females. Very often two or three younger bucks coloured like the does remain with the latter; but these young males are sometimes driven away by older bucks, and form separate herds. This antelope never enters forest nor high grass, and is but rarely seen amongst bushes. Where not much pursued or fired at, it will often allow men to come in the open within about 150 yards, sometimes nearer. Of country-carts, bullocks, or coolies carrying loads, it often takes but little notice at half that distance.

GSL

Like most animals of open plains, the Indian antelope appears to have no particular hours for feeding, though it generally rests in the middle of the day. I cannot say it never drinks, for I have been assured by several people that it does, but I cannot help suspecting that its visits to the neighbourhood of water are for the purpose of feeding on the fresh grass to be found there. That it can exist without ever drinking is proved by its abundance between the salt Chilka Lake in Orissa and the sea, on a spit of sand 30 miles long, where the only drinking-water is from a well.

The speed and endurance of the antelope are well known. Col. W. Campbell, in 'My Indian Journal,' relates how his brother, on a fast Arab horse, once ran down and speared a buck near Dharwar, but the feat has not often been repeated. Wounded antelope are often ridden down, but sometimes require a good horse to catch them. I was once completely beaten on fair ground by a buck with a broken fore-leg, but I was on a horse that, although speedy, had but little endurance. Jerdon says: "Very rarely good greyhounds have pulled down this antelope unwounded on ordinary ground; but there are at least three localities where this coursing used to be practised successfully." The localities were on heavy sand at Pooree in Orissa and at Sirsa in the Punjab, and on fine pasture land at Point Calimere, south of Trichinopoly. Jerdon adds that on soft ground, during the rains, antelope are easily caught by good dogs. He also says: "Greyhounds are very keen after a wounded antelope, and occasionally get savage and fight over it when pulled down." This is confirmed by McMaster.

The Indian antelope, like the South-African springbok (*Gazella euchore*), has the habit of occasionally springing into the air, all the members of a herd generally bounding, one after the other. This is done, as Sir W. Elliot has shown, before they are much frightened, and when the herd is first moving off. When at speed the gallop is like that of any other animal.

Occasionally these antelopes conceal themselves in grass or cultivation, and wounded animals not unfrequently hide. Young fawns, too, are generally concealed by the mothers. The only sound I have ever heard the buck utter is a peculiar grunt that he makes when excited; the females have a hissing alarm note, according to Forsyth. Like most other Indian antelopes, they deposit their dung repeatedly on the same spot.

Like most antelopes, and indeed ruminants in general, this species is easily tamed, if captured young. Many used to be taken in nets or in snares, and one native method of capturing the bucks was to send a tame black buck with nooses attached to his horns into the herd, and to seize the wild one when entangled in the fight which inevitably ensued. The bucks are greatly given to fighting. "The rutting-season," says Mr. Elliot, "commences about February or March, but fawns are seen of all ages at every season. During the spring months the buck often separates a particular doe from the herd, and will not suffer her to join it again, cutting her off and intercepting every attempt to mingle with the rest. The two are often found alone also, but on being followed always rejoin the herd." A buck may frequently be seen chasing one particular doe. I cannot find the period of gestation recorded.

The flesh of the Indian antelope is excellent.

Genus **PANTHOLOPS**, Hodgson (1834).

Tail short. No suborbital glands. Large interdigital glands in all feet. Inguinal glands very large. No muffle. The muzzle peculiarly swollen in the male; nostrils large and furnished inside with extensive sacs. Mammæ 2.

Skull with very prominent orbits directed forwards: premaxillæ long, narial opening large; the frontal region gently rounded off into the parietal; occiput nearly at right angles to parietal region. No horns in females. Horns of male long, erect, arising near together, very slightly curved, sublyrate, greatly compressed laterally, ringed subdistantly in front but not behind.

Only one species exists, and this is peculiar to the Tibetan plateau, where remains of an allied form have been found fossil.

358. **Pantholops hodgsoni.** *The Tibetan Antelope.*

Antilope hodgsonii, *Abel, Phil. Mag.* lxviii, p. 234 (1826); *id. Edinb. Jour. Sci.* vii, 1827, p. 164; *Hodgson, Gleanings Sc.* ii, p. 348, pls. iii, iv; *id. P. Z. S.* 1831, p. 52; *id. J. A. S. B.* i, p. 59, pl. iv; iii, p. 134.

Antilope (Oryx) kemas, *H. Smith, Griffith's An. King.* v, p. 196 (1827).

Antilope chiru, *Lesson, Man. Mam.* p. 371 (1827).

Pantholops hodgsonii, *Hodgson, P. Z. S.* 1834, p. 80; *Adams, P. Z. S.* 1858, p. 521; *Blanford, Yark. Miss., Mam.* p. 89, pl. xvi; *W. Sclater, Cat.* p. 163.

Kemas hodgsonii, *Gray, List Mam. B. M.* 1843, p. 157; *Horsfield, Cat.* p. 166; *Blyth, Cat.* p. 173; *Blanford, J. A. S. B.* xli, pt. 2 p. 39.

Tsús ♂, *Chus* ♀, *Chiru*, *Chuku*, Tibetan.

Fur very thick and close, erect, very woolly near the skin. Hoofs pointed.

Colour very pale fawn (light rufous brown) above, the hair pinkish (or, according to Hodgson, slaty grey) towards the base, white below. The whole face and a band down the front of each leg dark brown or black in males; females have no black marks.

Dimensions. A male was 32 inches high at the shoulder, 50 in length from nose to rump, tail with hair 9, ear 5½, girth of body 39 (*Hodgson*). The corresponding dimensions in a female were 27·5, 50 (over curves), 7, 5·8, and 35 (*Stoliczka*). A male skull is 9·8 in basal length, and 4·6 in orbital breadth. Horns are 24 to 26 inches long, exhibiting very little variation, and 5·5 to 6 in girth at the base, maximum recorded dimensions being 27·5 and 6·5.

Distribution. Probably throughout the Tibetan plateau, from 12,000 to 18,000 feet elevation. Found in Northern Ladak, north of Kumaun, north of Sikhim, and also in Northern Tibet.

Habits. The Tibetan antelope is shy and wary. It is sometimes seen solitary or in small parties of three or four, sometimes in large herds, which are said at times to consist of hundreds. The sexes live apart in summer, and Kinloch, who has given a good account of this animal's habits, says he never saw a doe in Changchenmo, where bucks are not rare. This antelope keeps to the plains and open valleys, feeding morning and evening on the patches of grass, especially those on the banks of streams, and lying down during the day on the flats, in which, Kinloch says, it excavates hollows deep enough to conceal its body.

According to Hodgson, the Tibetan antelopes rut in winter; the females gestate for 6 months and produce a single young in summer.

Genus **GAZELLA**, Blainville (1816).

Syn. *Procapra*, Hodgs. (1846); *Tragops*, Hodgs. (1847); *Tragomma*, Hodgs. (1848).

Size small or moderate. Frame slender. Eyes large. Tail short. Suborbital glands small, sometimes wanting. Interdigital glands in all feet. Inguinal glands generally present. No muffle.

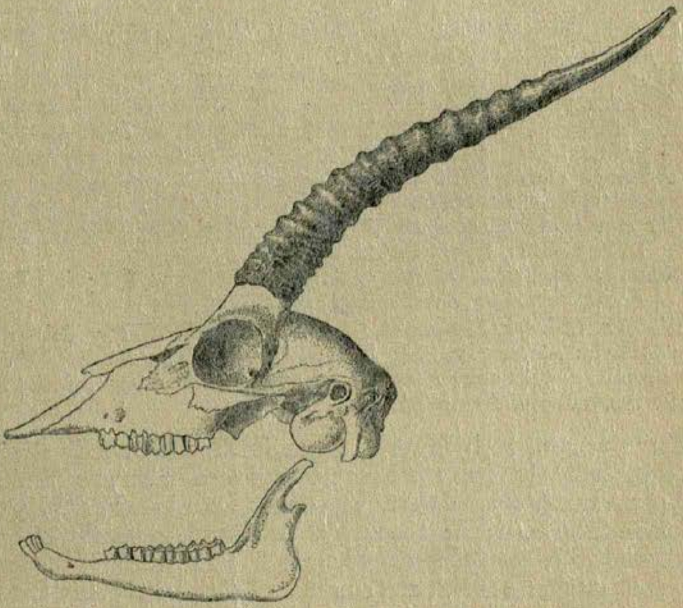

Fig. 171.—Skull and horns of *Gazella bennetti*.

Mammæ 2. Hoofs pointed. Generally a tuft of longer hair on each knee.

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Skull resembling that of *Antilope*, but shorter in proportion. Nasals short. Lachrymal fossa variable; a distinct lachrymal fissure. Auditory bullæ large. Horns sometimes in both sexes, those of the male compressed, oval in section, erect, with a more or less marked sigmoid curve, sublyrate or lyrate, surrounded by subdistant prominent rings almost throughout.

This genus contains more than 20 species, distributed throughout Africa, Western and Central Asia (Brooke, P. Z. S. 1873, p. 535). Remains belonging to it are found in Indian Pleistocene and Pliocene deposits, those in the former agreeing with *G. bennetti.*

Synopsis of Indian Species.

A. Females horned. Horns not turning inwards at points; no caudal disk	*G. bennetti*, p. 526.
B. Females hornless.	
a. No caudal disk. Horns lyrate; the tips turned inwards	*G. subgutturosa*, p. 528.
b. A white disk surrounding the tail. Horns much curved	*G. picticaudata*, p. 529.

359. **Gazella bennetti.** *The Indian Gazelle.*

Antilope bennettii, *Sykes, P. Z. S.* 1831, p. 104; *Blanford, J. A. S. B.* xxxvi, pt. 2, p. 196.
Antilope arabica, *Elliot, Mad. Jour. L. S.* x, p. 223 (1839), *nec Licht.*
Gazella christii, *Gray, apud Blyth J. A. S. B.* xi, p. 452 (1842); *Hutton, J. A. S. B.* xv, p. 151.
Gazella bennetti, *Gray, List Mam. B. M.* 1843, p. 161; *Hutton, J. A. S. B.* xv, p. 150; *Jerdon, Mam.* p. 280; *Stoliczka, J. A. S. B.* xli, p. 229; *Blanford, P. Z. S.* 1873, p. 315; *Brooke, P. Z. S.* 1873, p. 544; *Ball, P. A. S. B.* 1877, p. 172; *W. Sclater, Cat.* p. 159.
Antilope hazenna, *Is. Geoffr. Jacquemont, Voyage*, iv, *Zool.* p. 74, *Atlas*, ii, pl. vi (1844).
Tragops bennetti, *Hodgson, J. A. S. B.* xvi, p. 695; *Adams, P. Z. S.* 1858, p. 522; *Blyth, Cat.* p. 173.
Gazella fuscifrons, *Blanford, P. Z. S.* 1873, p. 317; *id. Eastern Persia*, ii, p. 92; *Brooke, P. Z. S.* 1873, p. 545.

Chinkára, Chikára, Kal-punch, H.; *Phaskela*, N.W. P.; *Ask* or *Ast, Ahu*, Baluch; *Khazm*, Brahui; *Kalsipi*, Mahr.; *Tiska, Budári, Mudari*, Can.; *Sank-húlé*, Mysore; *Porsya* ♂, *Chari* ♀, Baori; *Burudu-jinka*, Tel.; *Ravine deer* of some Anglo-Indians.

Horns present in both sexes, those in the male nearly straight, diverging slightly from the base when viewed from the front, but having a slight S-shaped curve when seen from the side, the points curving a little forward; the number of rings is generally 15 or 16, but is said to be sometimes as many as 25; the horns in the female are much smaller, smooth and conical. Infraorbital gland distinct, having a small opening.

Colour above light chestnut, a little darker where it joins the white on the sides and buttocks; no pale lateral bands; chin, breast, lower parts, and back of thighs white, the white colour not ascending to the root of the tail; tail nearly black, knee-brushes varying, often dark brown; a whitish streak down each side of the face; middle of face from base of horns to nostrils darker rufous, sometimes with a dusky patch above the nose; a rufous stripe outside each pale facial band.

Dimensions. An adult male measured 26 inches high at the shoulder, 28·5 at the croup, nose to rump 41·5, tail 8·5, ear 6, horns 11 (*Elliot*). Weight of bucks about 50 lb., of does 35 to 40. Basal length of a male skull 6·75, orbital breadth 3·6. Horns measured in front along the curve are usually 10 to 12 inches long, with a girth of 4 at the base; the largest recorded dimensions in males are 14 and 5, the longest known female horns measure 8 inches.

Distribution. Throughout the plains and low hills of North-western and Central India, extending throughout Baluchistan to the eastern shore of the Persian Gulf. This gazelle is found in a considerable part of the Peninsula, ranging in suitable localities throughout the Punjab., Sind, Rajputana, the N.W. Provinces, and the whole Bombay Presidency with the exception of the Western Ghats and Konkan; also Central India as far east as Palamow and Western Sarguja, and the Central Provinces as far east as Seoni and Chánda, together with the Hyderabad territories, and the Madras Presidency to a little south of the Kistna, gazelles being found at Anantapur, south of Kurnool, and in Northern Mysore.

Varieties. G. fuscifrons was described from a doe with distinctly, though not prominently ringed horns, 7·25 inches long, and with the dark portions of the face dark brown, obtained at Jálk in Northern Baluchistan. Sir O. B. St. John, after long search, obtained what he justly concluded must be the male, and this proved to be *G. bennetti.* The rather pale form of this gazelle from the Indian desert and Sind has been distinguished as *Gazella christii*, but is perfectly identical with the Central Indian type.

Habits. The Indian gazelle is far less gregarious than the Indian antelope, and is most commonly seen in small parties of from two to six, though I have found from ten to twenty associating in a herd. It keeps much to waste ground, especially where that is broken up by ravines, but it is seldom seen on alluvial plains, and it haunts cultivation less than the antelope. It is freqnently found amongst scattered bushes or thin tree-jungle, and may be met with on undulating ground even on the top of hills; it is commonly found amongst sand-hills, and is nowhere so abundant as in parts of the Indian desert. It lives on grass and the leaves of bushes, and I believe never drinks, for it is common in tracts where there is no water except from deep wells; and although I was on the look out for some years, and saw the tracks of almost every common wild animal at the pools in stream-beds, the only water remaining in many places in the hot season, I never saw the easily recognized prints of the gazelle's hoofs. It is, however, fond of the green grass near water.

GSL

Gazelles are very swift and can but rarely be caught by dogs. The present species does not bound like the Indian antelope when disturbed. It has a peculiar habit of uttering a sharp hiss when alarmed and of stamping with its fore-foot. The doe is often seen followed by two fawns. I cannot find that the rutting-season or the period of gestation has been observed. The flesh is excellent. This species has the habit of dropping its dung repeatedly in the same spot to a greater extent than the Indian antelope, but it not unfrequently resorts to heaps of nilgai dung for the sake of depositing its own.

Gazella dorcas and several allied forms found in Northern and Eastern Africa, *G. arabica* and *G. muscatensis* from South Arabia, are nearly allied to *G. bennetti*.

360. **Gazella subgutturosa.** *The Persian Gazelle.*

Antilope subgutturosa, *Güldenstädt, Act. Acad. Petrop.* i, p. 251, pls. ix–xii (1778).

Gazella subgutturosa, *Blainv. Bull. Soc. Philom.* 1816, p. 75; *Hutton, J. A. S. B.* xv, p. 151; *Blyth, Cat.* p. 172; *Blanford, P. Z. S.* 1873, p. 313; *id. Eastern Persia*, ii, p. 91; *id. Yark. Miss., Mam.* p. 88, pl. xv; *Brooke, P. Z. S.* 1873, p. 545; *Scully, J. A. S. B.* lvi, pt. 2, p. 76; *Thomas, Tr. L. S.* (2) v, p. 64; *W. Sclater, Cat.* p. 160.

Ahu, Persian.

Females hornless. Horns in males lyrate, diverging near the base and with the tips turned inwards and converging; viewed from the side the curve is S-shaped, but slight. Rings strongly marked, 16 to 25 in number. A distinct infraorbital gland and well-marked lachrymal fossa.

Colour. Upper parts rufescent sandy, lower parts and buttocks up to the base of the tail, but not including it, white; colours sharply divided on the side. A distinct dark pygal band on the edge of the white buttocks. Facial markings not very distinct, but the usual pale lateral bands down each side of the face are present, and also the median and lateral dark facial bands. Tail blackish brown.

Dimensions. Nearly identical with those of *G. bennetti*. Eastern Turkestan individuals may be rather larger. Basal length of a Persian male skull 6·75 inches, orbital breadth 3·4; of a Yarkand skull 7·5 and 3·7. The longest horns I have heard of were from Herat, and measured 14·7 inches with a basal girth of 4·5 (Scully, *l. c.*).

Distribution. Throughout the highlands of Persia, and an enormous area in Central Asia extending through Eastern Turkestan to the Gobi desert. This is the gazelle of Afghanistan and Candahar, but only occurs in British territory in Pishin, north of Quetta, as I was informed by the late Sir O. B. St. John.

Habits. Very similar to those of *G. bennetti*, except that the present species is even more of a desert animal and that it has a less tropical habitat.

A considerably larger species, *G. gutturosa*, with shorter, very pale-coloured horns, inhabits parts of Mongolia.

361. **Gazella picticaudata.** *The Tibetan Gazelle.*

Procapra picticaudata, *Hodgson, J. A. S. B.* xv, p. 334, pl. (1846), xvi, p. 696; *Blyth, J. A. S. B.* xvi, p. 725; *id. Cat.* p. 173; *Adams, P. Z. S.* 1858, p. 523; *Blanford, J. A. S. B.* xli, pt. 2, p. 39.
Gazella picticaudata, *Brooke, P. Z. S.* 1873, p. 547; *W. Sclater, Cat.* p. 161.

Goa, Rágao, Tibetan.

Females hornless. Horns in males slender, diverging, very much curved back, the tips curving forwards, but not or very little inwards; from the point the horns look nearly straight. Annulation less strongly marked but closer together than in the other Asiatic species; 25 to 30 rings in adults. No infraorbital orifice, a naked space on the face corresponding to the position of the gland; lachrymal fossa very shallow. No knee-brushes. Hair in winter long and soft, particularly long about the corners of the mouth. Tail and ears very short.

Colour above in winter light sandy fawn, grizzled by the pale tips of the hairs, greyer in summer. Lower parts white, not very sharply divided from the colour of the back; the white of the buttocks extends all round the base of the tail, forming a distinct caudal disk; tip of the tail dark rufous brown or black; no lateral or facial markings; the fawn colour of the back becomes more rufous on the border of the caudal disk.

Dimensions. Height of a fine male at shoulder 24 inches, snout to rump 43, tail 0·75, ear 5, horns along curve 13 (*Hodgson*); longest recorded horns 15·75 measured along the curve in front; greatest basal girth 4. Basal length of a male skull 6·8, orbital breadth 3·7.

Distribution. The Tibetan plateau from about 13,000 to about 18,000 feet. Found commonly in Ladak and north of Nepal and Sikhim.

Habits. Very similar to those of other gazelles. This species inhabits the bleak plains of the Tibetan plateau in small parties varying from two or three to about a dozen. They are not generally very shy, and according to Kinloch are but little frightened by noise; they are even said to pay but little attention to men passing to windward.

In the Pliocene period antelopes were represented in India by many forms now restricted to Africa. Amongst these ancient Indian antelopes were species of *Alcelaphus* (hartebeest, &c.), *Hippotragus* (sable antelope, &c.), and probably of *Cobus* (water-buck, &c.), *Cephalophus* (duikerbok), *Oreas* (eland), and *Strepsiceros* (kudu).

Although the *Giraffidæ* no longer exist in India, several extinct genera belonging to the family and one species of true giraffe have been discovered in the Indian Pliocene beds. Amongst the extinct forms *Sivatherium* is the best known; it was a large animal with two pairs of horns.

Family CERVIDÆ.

Horns, when present, taking the form of solid antlers, without core or horny sheath, and shed periodically. With but few exceptions (and those not Indian) the horns are confined to the male sex. A large lachrymal fissure in the skull. Upper canines generally present in both sexes. Molars more or less brachydont, the first molar in both jaws especially so. The lateral digits almost always present on all feet, and frequently the distal ends of the metapodials. No gall-bladder except in *Moschus*. A small muffle almost always developed. Infraorbital glands always present, and interdigital generally. Mammæ always four, inguinal. Placenta with few cotyledons.

The horns are composed of true bone, and during their growth are enclosed in a hairy integument supplied with blood-vessels, and known as the "velvet." When the growth is complete the integument dries and peels off. The horns are shed, as a rule, annually, and are replaced by others in the course of from three to six months. The horns increase in size year by year up to maturity, but aged stags bear small and inferior horns.

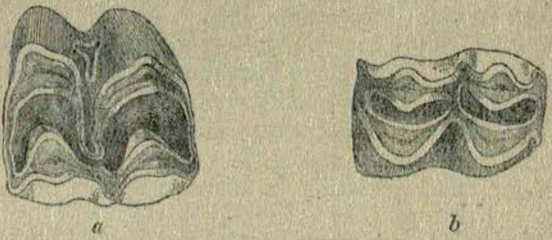

Fig. 172.—Crowns of (*a*) upper and (*b*) lower second true molars of *Cervus unicolor*, inner side uppermost.

Two subfamilies are recognized; both are Indian, and they are thus distinguished:—

Horns generally present in males. No gall-bladder ..	*Cervinæ*.
No horns. A gall-bladder........................	*Moschinæ*.

The true deer are widely distributed, being found throughout the Palæarctic and Oriental regions of the Old World, and in both North and South America, but they are wanting in Africa south of the Sahara, and, of course, in Australia.

The following terms are applied to the horns of deer:—Each entire horn is composed of a "beam" or main stem, and minor branches known as "tines," "antlers," or "snags." Sometimes the beam and branches are flattened or "palmated," as in the elk and fallow-deer, but generally they are rounded. The whole horn rests on a bony support or "pedicel," which is never shed, and

GSL

there is a swelling, the "burr," at the base of the deciduous portion. The tine immediately above the burr is the "brow tine" or "brow antler;" and in most Indian deer this is the only tine developed, except near the end of the horn. But in the Elaphine group of deer, to which *Cervus cashmirianus* belongs, there are two more tines springing from the beam above the brow tine, the second being known as the "bez" and the third as the "tres" (pronounced bey and trey); by many writers the tres is called the "royal." The terminal tines are known collectively as the "crown," and if they are three in number on each horn the stag is termed "royal." The inner angle between the brow tine and the beam is sometimes called the "axil."

Subfamily CERVINÆ.

No gall-bladder. Two orifices to the lachrymal canal, both on the margin of the orbit. Hemispheres of brain considerably convoluted. Cotyledons of placenta distributed over the surface.

The arrangement of Sir V. Brooke (P. Z. S. 1878, p. 889), here followed, divided the deer into *Plesiometacarpi*, with the proximal ends of the lateral metacarpals remaining, and *Telemetacarpi*, with the distal ends only. The two Indian genera belong to the first-named, and may readily be discriminated thus:—

Short horns, pedicels as long as antlers or longer. No phalanges to lateral digits	CERVULUS.
Long horns on short pedicels. Bony phalanges of lateral digits present	CERVUS.

Genus **CERVULUS**, Blainville (1816).

Syn. *Stylocerus*, H. Smith (1827); *Prox*, Ogilby (1836); *Muntjacus*, Gray (1843).

Antlers not exceeding half the length of the head, on pedicels as long as themselves or longer. A very short brow antler, the beam above undivided, but curved downward and inward at the extremity. In females there is a bristly tuft of hair and a small projection in place of each horn. A bony ridge extends from the base of the pedicel or tuft above the orbit, and down each side of the face, the two ridges converging anteriorly; there is a frontal cutaneous gland inside each ridge. Lachrymal fossa in skull very deep, and including the facial portion of the jugal; lachrymal fissure moderate. Upper canines of males very large, those of females small. Muffle large. Interdigital glands large, but confined to the hind feet. No tuft of long hair on the metatarsus. No traces of the phalanges of the lateral digits. Vertebræ: C. 7, D. 13, L. 7, S. 5, C. 13–14 (*Hodgson*).

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The anatomy of *C. muntjac* has been described by Hodgson (J. A. S. B. xvii, pt. 2, p. 483).

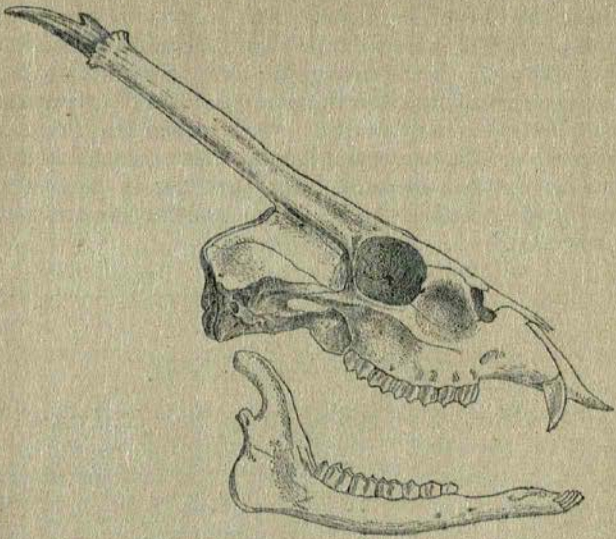

Fig. 173.—Skull and horns of *Cervulus muntjac.*

The genus *Cervulus* is found throughout the Oriental region, and is restricted to it.

Synopsis of Indian and Burmese Species.

Colour chestnut-red	*C. muntjac*, p. 532.
Colour sepia-brown	*C. feæ*, p. 534.

362. **Cervulus muntjac.** *The rib-faced Deer or barking Deer.*

Cervus muntjak, *Zimm. Geog. Gesch.* ii, p. 131 (1780); *Sykes, P. Z. S.* 1831, p. 104; *Elliot, Mad. Jour. L. S.* x, p. 221.
Cervus muntjak *and* vaginalis, *Boddaert, Elench. Anim.* i, p. 136 (1785).
Cervulus moschatus, *Blainville, Bull. Soc. Phil.* 1816, pp. 74, 77; *Horsfield, Cat.* p. 190.
Cervus aureus, *Ham. Smith, Griffith's Cuv. An. King.* iv, p. 148 (1827).
Cervus ratwa, *Hodgson, As. Res.* xviii, pt. 2, p. 139, pl. (1833).
Cervus melas, *Ogilby, Royle's Bot. Himal.* p. lxxiii (1839).
Styloceros muntjak, *Cantor, J. A. S. B.* xv. p. 269.
Stylocerus muntjacus, *Kelaart, Prod.* p. 85 (1852).
Cervulus vaginalis, *Adams, P. Z. S.* 1858, p. 530; *Blyth, Cat.* p. 154.
Cervulus aureus, *Jerdon, Mam.* p. 264; *Blyth, Mam. Birds Burma,* p. 46.
Cervulus moschatus, curvostylis, *and* tamulicus, *Gray, Hand-list Edentate &c. Mam. B. M.* pp. 163, 165 (1873).
Cervulus muntjac, *Brooke, P. Z. S.* 1874, p. 38, 1878, p. 899; *Anderson, An. Zool. Res.* p. 337; *W. Sclater, Cat.* p. 173.

Kákar, H.; *Ratwa*, Nepal; *Karsiar*, Bhot; *Sikku*, Lepcha; *Maya*, Beng. Rungpore; *Gutra* ♂, *Gutri* ♀, *Bherki*, Gond; *Bekra*, *Bekar*, Mahr.; *Kánkari*, *Kárd-kari*, *Kond-kari*. *Cháli*, Can.; *Kúka-gori*, Tel.; *Kalai*, *Katu-ardu*, Tam.; *Weli*, *Hula-muha*, Cing.; *Huyeri*, Assam; *Gyi*, Burm.; *Kidang*, Malay; *Jungli-bakri* and *Jungle-sheep*, vulgarly, in Southern India.

Colour deep chestnut, becoming darker on the back and paler and duller below. Face and limbs brownish, a black line along the inside of each horn-pedicel and for some distance inside the facial rib; this line in the female ends above in a slight tuft. Chin and upper throat, lower abdomen, lower surface of tail and inside of thighs white; a whitish mark in front of the digits on each foot. Axils whitish. A dark brown variety has been found near Darjiling by Kinloch, and a still darker form is figured in Hodgson's MS. drawings. Young spotted.

Dimensions. Height at shoulder 20 to 22 inches; length of head and body about 35; tail, with hair, 7. A male skull measures 7 inches in basal length and 2·7 in breadth across the orbits. The horns from the burr (pedicel not included) rarely exceed 5 inches in length, and are generally 2 or 3 inches, on pedicels 3 to 4 long, but horns of 11 inches are said to have been measured. Weight of a male 38 lb.

Distribution. Throughout India, Ceylon, and Burma on all thickly-wooded hills, never in the plains, nor, so far as I am aware, away from tree-forest. This deer ascends the Himalayas to about 5000 or 6000 feet, and sometimes even higher. It is rare in the Central Provinces and farther to the north-west, but I have known it killed near Baroda, and it probably occurs on the Aravalli range. Outside of India it is found throughout the Malay Peninsula, Sumatra, Java, Borneo, and eastward to Hainan, though replaced by *C. reevesi* in parts of Southern China.

Habits. The rib-faced deer is a solitary animal, usually found singly or in pairs. It keeps in thick jungle, only leaving the forest to graze on the skirts of the woods or in abandoned clearings. It has a wonderful way of getting through the thickest underwood, and it runs in a peculiar manner with its head low and its hind quarters high; when not alarmed, as Colonel Hamilton observes, it steps "daintily and warily, lifting each leg well above the grass or leaves."

The call of this species, from which the common name of "barking deer" is derived, is at a little distance very like a single bark from a dog, and is very loud for the size of the animal. It is often repeated at intervals, usually in the morning and evening, sometimes after dark, and I have heard it in Burma very late in the morning and again in the afternoon, in the cold weather, which is the rutting-season. It is uttered by the animal when alarmed, as well as when calling its mate.

Elliot and Jerdon state that the tongue is very long and extensile, and this deer often licks the whole face with it. McMaster and Sterndale confirm this. The latter has found that in confinement

This deer is a coarse feeder and fond of cooked meat. When the buck is attacked by dogs it uses its canine teeth in defence and inflicts severe wounds with them. Colonel Hamilton has pointed out that these teeth are not fixed firmly in the jaw, but that the animal has some power of moving them. Several observers have noticed a peculiar rattling noice, like that produced by a pair of castanets, made by this deer when running, but the cause is not known. Adams suggests that the sound is produced by the feet, Hamilton and McMaster think it may be made by the long canine teeth, but Kinloch says he has heard it made by a female, though he also thinks it is produced by the mouth.

The rutting-season in Northern India is chiefly in January and February, the period of gestation is six months, and the young are born, as a rule, in June and July, but some young are said to be produced throughout the year; the female has one or two young at a birth. The horns of the male fall in May and the new horns are perfect in August. These details are from Hodgson. The flesh is very good, superior to that of other Indian deer in general.

363. **Cervulus feæ.** *Fea's rib-faced Deer.*

Cervulus feæ, *Thomas & Doria, Ann. Mus. Civ. Gen.* 2, 2 *a*, vii, p. 92 (1889).

A short tuft of hair between the horns.

Colour above sepia-brown, speckled with golden brown, the hairs of the back having golden-yellow tips. Legs darker. Lower parts light brown. Forehead, horn-pedicels, and occiput brownish yellow, with a blackish line down the inside of each pedicel to the brown of the face. The hair around the hoofs, an indistinct line up the front of each carpus and tarsus, and a distinct band, growing broader above, up the front of each thigh, white. Tail with a narrow black band above, the rest white.

Dimensions of the type, a male :—Total length 34·6 inches; tail without hair 4, with hair 5·7; hind foot and tarsus 11·3; horn 2.

Distribution. The only specimen known was obtained on Muleyit mountain, west of Moulmein, by Mr. L. Fea.

Genus **CERVUS**, Linn. (1766).

Syn. *Rusa, Axis,* H. Smith (1827); *Rucervus,* Hodgson (1838); *Pseudocervus,* Hodgson (1841); *Procervus,* Hodgson (1847); *Panolia,* Gray (1843); *Hyelaphus,* Sundevall (1846).

Antlers large, two or three times the length of the head, on short pedicels. Upper canines never large and sometimes wanting. No bony ridge on the face. The parietal region of the skull forms an obtuse angle with the frontal plane, and a right angle with the occipital. There is a large and deep lachrymal fossa, and an extensive fissure or vacuity between the frontal, nasal, maxillary, and lachrymal bones. The suborbital glands are large; interdigital variable. A moderate-sized muffle. A tuft of hair generally on the outer surface of the metatarsus above the middle. Phalanges of the lateral digits present.

Vertebræ: C. 7, D. 13, L. 6, S. 4, C. 11–14.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Each horn in adults normally with more than three tines.	
a. Brow and bez tines present; usually a pale caudal disk..........................	*C. cashmirianus*, p535.
b. Brow tine, no bez; no caudal disk.	
a′. Brow tine and beam meet at a right angle.	*C. duvauceli*, p.538.
b′. Brow tine forming a continuous curve with beam	*C. eldi*, p.541.
B. Each horn in adults normally with three tines.	
a. Never spotted; large, height 48 to 56 inches.	*C. unicolor*, p.543.
b. Always spotted; height 30 to 38 inches ..	*C. axis*, p.546.
c. Spotted in summer only; height less than 30 inches..........................	*C. porcinus*, p.549.

The members of this genus, like those of *Bos*, have been divided amongst several genera by many naturalists, but the differences are scarcely of generic importance, and the number of intermediate forms between the best-marked types, such as Red Deer and Sámbar, renders it difficult to separate them. Of the Indian species, *C. cashmirianus* alone belongs to the Elaphine group, or true *Cervus*, which comprises the European Red Deer (*C. elaphus*) and the American Wapiti (*C. canadensis*). The other Indian species belong to the Rusine group, with a large muffle and no bez tine, and have been distributed amongst several small genera, *C. unicolor* being the type of *Rusa*, *C. duvauceli* of *Rucervus*, *C. eldi* of *Panolia*, *C. axis* of *Axis*, and *C. porcinus* of *Hyelaphus*, the last species having also been referred alternately to *Rusa* and *Axis*.

Indian fossil forms are not numerous. *C. unicolor*, *C. axis*, *C. porcinus*, and perhaps *C. duvauceli*, are represented in the Pleistocene beds of the Peninsula, and three extinct forms, one allied to *C. duvauceli*, in the Pliocene Siwaliks.

364. **Cervus cashmirianus.** *The Kashmir Stag.*

"Kashmir Stag," *Blyth, P. Z. S.* 1840, p. 79; *id. J. A. S. B.* x, p. 750, plate, figs. 8, 9; xxiii, p. 734.

Cervus cashmerensis, *Falconer, apud Gray, List Ost. Spec. B. M.* p. 65 (1847) (no description); *Adams, P. Z. S.* 1858, p. 529; *Lydekker, J. A. S. B.* xlvi, pt. 2, p. 286

Cervus wallichii, *Wagner, Hugel's Kaschmir*, iv, p. 576; *Blyth, J. A. S. B.* xxx, p. 188; *id. Cat.* p. 146; *Jerdon, Mam.* p. 250; *nec Cuv. Hist. Nat. Mam.* pl. 356 (1823).

Cervus cashmeerianus, *Falconer, Pal. Mem.* i, p. 576 (1868); *Sclater, Tr. Z. S.* vii, p. 339, pl. xxx; *Brooke, P. Z. S.* 1878, p. 912; *Scully, J. A. S. B.* lvi, p. 76; *W. Sclater, Cat.* p. 184.

Hangal, *Honglu*, ♂, *Minyamar* ♀, Kashmir; *Bárasingha*, H.

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Size large. In males the hair on the ridge of the neck is long, thick, and bushy, and the hair of the lower neck long and shaggy. Muffle small. Horns with brow, bez, and tres or royal tines, and usually in adults each horn with five points, sometimes with more. The tines, with rare exceptions, are undivided. The bez or second tine, as a rule, considerably exceeds the brow or first tine in length.

Colour brown or brownish ash, or dark liver-colour; a whitish caudal disk surrounding the tail, contrasting strongly with the dark border that merges into the body-colour; sides and limbs paler; lips and chin white, ears whitish. In summer the fur is brighter and more rufous, the lower parts albescent, the belly in the male dark brown. Young fawns are spotted, the markings being retained, according to Adams, till the third or fourth year.

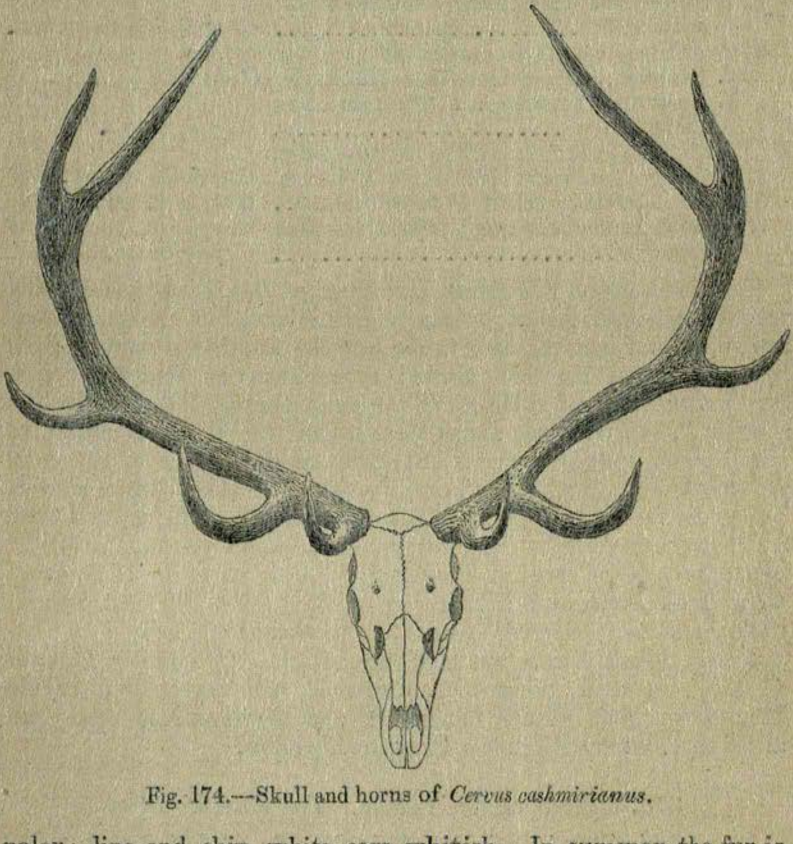

Fig. 174.—Skull and horns of *Cervus cashmirianus*.

In Sclater's figure, from an animal in the Zoological Gardens, there is no caudal disk; the tail is dark brown above, pale below, and only the buttocks pale rufous. Whether this is due to variation in colouring or to age it is impossible to say, but a skin from the Zoological Gardens, now in the British Museum, agrees with the figure.

Dimensions. Height at shoulder 48 to 52 inches, length 7 to 7½ feet, tail 5 inches. Extreme length of a male skull 15·1 inches, breadth 7·5. Horns in adults average about 40 inches in length, and 5½ to 6 in girth at mid-beam; the longest known measure 52, 53·5, and 55 along the inside from the burr to the tip; basal girth 2·5, clear of the burr; girth at mid-beam 7.

Distribution. The Kashmir valley, throughout the pine-forests between about 9000 and 12,000 feet in summer, lower in winter. Not found east or north of Kashmir; a few occur in Wardwan, Kishtwár, Badrawár, &c.; none in Ladak. The range westward is not known; a horn referred to this species was obtained from the banks of the Oxus near Balkh by Captain Yate, but the identification is open to doubt, as there are several Asiatic stags allied to the Kashmir animal.

Habits. The Kashmir deer are found singly or in small parties in summer, the males generally alone. In the winter they collect into larger herds. The males generally shed their horns in March, and the new horns are not perfect till October, when, as Adams states, "the rutting-season commences and the loud bellowings of the stags are heard all over the mountains." The voice of the Kashmir stag, according to Sir V. Brooke, resembles that of the wapiti, and differs from that of the European red deer. "In the former it is a loud squeal ending in a more guttural tone; in the latter it is a distinct roar, resembling that of a panther."

According to Adams, these deer "are seldom confined to one locality, but roam from forest to forest, preferring grassy glades alternating with dense forest, where there is a copious supply of water." The young are born in April, so the period of gestation must be about six months.

A much larger species than *C. cashmirianus* inhabits one or more wooded upland tracts north of Bhutan, but belonging to Tibet. This stag, *C. affinis* (Hodgson, J. A. S. B. x, p. 721, pl.; xix, pp. 466, 518, pl.; xx, p. 388, pl. vii), called, but erroneously, the Sikhim Stag by Jerdon, must be excluded from the fauna of British India. It is not found in Sikhim nor in the Chúmbi valley, immediately east of Sikhim, but apparently in the next valley to the eastward. Mr. Hume was assured, he tells me, that the area inhabited by *C. affinis* is drained by streams running northward to the Sangpo. The coloration of *C. affinis* resembles that of *C. cashmirianus*. The caudal disk is well marked. The horns are large, 54 inches having been measured, and bear almost always five points each, but the principal distinction from *C. cashmirianus* is in the beam being much bent forward just above the origin of the tres tine. The bez is sometimes larger than the brow antler, but less constantly than in *C. cashmirianus*. A skull measures 18·25 inches in extreme length, another 17·5. The basal length of the latter is 16·25, breadth at orbits 7·35. All the skulls I have seen are conspicuously larger than those of *C. cashmirianus*.

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The animal to the figure of which, by Duvaucel, Cuvier gave the name of *C. wallichii*, lived in the Barrackpore menagerie, and was said to have been brought from Muktinath near Mount Dwálagiri in Nepal (Hardwicke, Tr. L. S. xiv, p. 581). This place is as nearly as possible halfway between the localities inhabited by *C. cashmirianus* and *C. affinis* respectively. It is difficult to believe that any large deer living in Northern Nepal could have escaped the knowledge of Hodgson's collectors. The shed horns of the type of *C. wallichii* are preserved in Calcutta, and have been figured (J. A. S. B. x, p. 750, pl., fig. 7); they are probably, according to W. Sclater, of the third year, but whether they agree better with those of *C. cashmirianus*, or *C. affinis*, of the stag of Eastern Turkestan, or of any other species, is undecided. The assigned locality must be regarded as very doubtful, and the name must remain in abeyance for the present. *C. narayanus* of Hodgson (J. A. S. B. xx, p. 392, pl. viii), founded on a single horn said to have been brought from Ladak, was probably a young *C. affinis*. No importance need be attached to the supposed locality; no stag is found in Ladak.

Recently (J. A. S. B. lviii, pt. 2, p. 186, pl. xi) W. L. Sclater has described a deer's dried head (with the skin) and horns purchased in the Darjiling bazaar, and has shown that they agree best with a stag called *Cervus dybowskii* by Taczanowski (P. Z. S. 1876, p. 123), and found in the Ussuri country, N.E. Manchuria, not far from Vladivostok. Additional evidence may be awaited before supposing that *C. dybowskii* extends to Tibet. It belongs to the Pseudaxine group, without a bez tine and usually with four points on each horn.

A fine elaphine stag inhabits the forests near the rivers east of Yárkand and Káshgarh, and appears to be nearly allied to the Western Asiatic deer known as *C. maral*, or perhaps identical with it. The great stag of the Thian Shan, for which (P. Z. S. 1875, p. 638, woodcut) I proposed the name of *C. eustephanus*, is a race of the American wapiti, *C. canadensis*, or a closely allied form. The other Asiatic elaphine deer are *C. xanthopygus*, widely distributed, and *C. luehdorfi* from Amoorland, the distinctness of which is doubtful. Besides *C. dybowskii*, *C. sika* from Japan, *C. mantchuricus* from Northern China, *C. caspicus* from Northern Persia, and some less known species belong to the Pseudaxine group.

365. **Cervus duvauceli.** *The Bárasingha.*

Cervus duvaucelii, *Cuv. Oss. Foss.* ed. 3, p. 505, pl. xxxix, figs. 6–8 (1825); *Anon. J. A. S. B.* v, p. 240; *Sclater, Tr. Z. S.* vii, p. 346, pl. xxxvi; *Brooke, P. Z. S.* 1878, p. 905; *W. Sclater, Cat.* p. 179.
Cervus bahrainja, *Hodgson, P. Z. S.* 1834, p. 99 (no description).
Cervus elaphoides, *Hodgson, J. A. S. B.* iv, p. 648, pl. liii, fig. 4 (1835).
Cervus (Rucervus) elaphoides, *Hodgson, A. M. N. H.* i, p. 154 (1838).
Cervus dimorphe, *Hodgson, J. A. S. B.* xii, p. 897, pl. (1843).

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Rucervus duvaucelii, *Hodgson, J. A. S. B.* xvi, p. 689; *Blyth, Cat.* p. 150; *id. P. Z. S.* 1867, p. 835, figs. 1-5; *Blanford, J. A. S. B* xxxvi, pt. 2, pp. 197, 199; *Jerdon, Mam.* p. 254; *Anderson, J. A. S. B.* xxxvi, pt. 2, p. 185, note; *Ball, Stray Feathers,* ii. p. 371.

Bárasingha, Máhá, H.; *Baraya, Gonr, Ghos,* Nepal Terai; *Jhinkar,* Kyarda Dún; *Goin,* Sind &c.; *Goinjak* ♂, *Gaoni* ♀, Central India; *Bára-Nerwari, Sál-Sámar,* Mundla; *Bhelingi pohu,* Assam. *Swamp deer* of Jerdon.

Size large. Hair moderately fine, rather woolly. Neck maned, tail moderate. Muzzle elongate. No interdigital glands (*Hodgson*). Skull narrow and long; premaxillaries produced considerably beyond the nasals. Horns smooth, with a brow-tine nearly at right angles to the beam, frequently bearing smaller points on its upper surface; sports in the axils are rare. Above the brow-tine the beam is unbranched for more than half its length; it then divides into two, each branch dividing again. In the normal adult horn figured in the accompanying cut the inner branch bears two tines, the outer three, but this number is often exceeded. Some remarkable horns are figured by Blyth *l. c.*, one pair of them having more than twenty points.

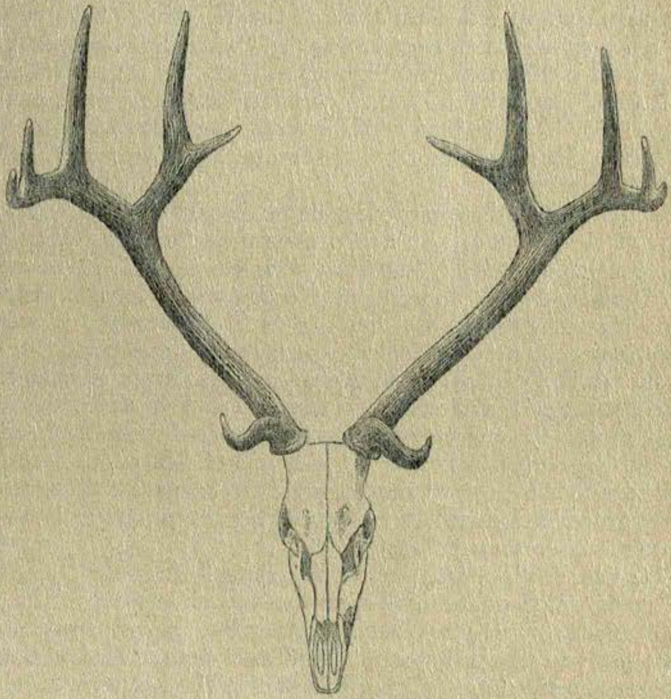

Fig. 175.—Skull and horns of *Cervus duvauceli.* (From a figure by Forsyth.)

Colour in winter yellowish brown above, paler below, in summer bright rufous-brown usually more or less spotted with white,

GSL

especially along the spine, whitish or white on the throat and belly and inside the thighs, and always white beneath the tail. Females paler than males. Young spotted.

Dimensions. Height at shoulder 44 to 46 inches; length nearly 6 feet; tail 8 to 9 inches, without hair 5; ear 7. Extreme length of a skull 15·3, breadth across orbits 6. Large stags in Cooch Behar are said to have weighed from 32 stone 12 lbs. to 40 stone 10 lbs., or 460 to 570 lbs. ('Asian,' April 3rd, 1891). Average horns measure 30 inches round the curve, with a girth of 5 at mid-beam; extreme measurements 38 and 5·25.

Distribution. Along the base of the Himalayas from Upper Assam to the Kyarda Dún west of the Jumna, throughout Assam, in a few places in the Indo-Gangetic plain from the Eastern Sundarbans to Baháwalpur and to Rohri in Upper Sind, and locally throughout the area between the Ganges and Godávari as far east as Mandla, this deer being common in parts of the Upper Nerbudda valley and to the south in Bastar and the neighbourhood. Forsyth has shown that the range of *C. duvauceli* in the Central Provinces corresponds with that of the sál tree (*Shorea robusta*) and red jungle-fowl (*Gallus bankiva*). In the Denwa valley, 150 miles west of the main sál region, and not far from Pachmarhi, an isolated patch of sál forest contains both this deer and the jungle-fowl. I have seen heads of this stag shot in Upper Sind by General Marston, and there are two on the mosque at Ghotki in the Rohri district.

Habits. The twelve-tined deer is not found in thick forest, but keeps on the skirts of the woods and on flat or undulating grass plains more or less interspersed with trees. It is known as the "Swamp-deer" in parts of North-eastern Bengal, but the term, though used as its English name by Jerdon, is scarcely appropriate. The bárasingha is sometimes met with in open forest. In the winter it is highly gregarious, herds of from thirty to fifty being met with, whilst in Mandla, and probably elsewhere, about September and October, several hundreds sometimes collect. The rutting-season follows. At the end of March in Assam the bucks are found in grass singly, with the horns for the most part partly grown and in velvet, so the old horns must there be shed as a rule not later than February.

This deer feeds chiefly on grass. Forsyth says that it is much less nocturnal than the sámbar, and although it rests in the shade about midday, it may be found grazing late in the forenoon and again early in the afternoon. Anderson found that a male in confinement was fond of lying in water in the hot season.

I have examined the type of *C. dimorphe*, and ascertained that it belongs to this species and not, as Blyth supposed, to *C. eldi*. Mr. Thomas, I find, had made the same identification.

An allied species, *C. schomburgki* (Blyth, P. Z. S. 1863, p. 155, 1867, p. 835, figs. 6–12), chiefly distinguished by the undivided portion of the beam in each horn being shorter than the branches, is found in Siam and may be met with in the Shan States east of Upper Burma.

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366. Cervus eldi. *The brow-antlered Deer or Thameng.*

"Nondescript species of Deer," *McClelland, Calc. Jour. N. H.* i, p. 501, pl. xii, figs. 1 *a*, 1 *b*.
Cervus eldii, *Guthrie* (*teste Blyth, P. Z. S.* 1867, p. 837), *Calc. Jour. N. H.* ii, p. 417, pl. xii (1842); *Beavan, P. Z. S.* 1867, p. 759; *Swinhoe, P. Z. S.* 1869, p. 653, figs. 1-3; *Sclater, Tr. Z. S.* vii, p. 348, pls. xxxvii, xxxviii; *Brooke, P. Z. S.* 1878, p. 906; *W. Sclater, Cat.* p. 180.
Cervus (Rusa) frontalis, *McClelland, Calc. Jour. N. H.* iii, p. 401, pls. xiii, xiv (1843); *Blyth, J. A. S. B.* xxviii, p. 296.
Panolia acuticornis, *Gray, List Mam. B. M.* 1843, p. 180 (no description); *Cantor, J. A. S. B.* xv, p. 272.
Panolia platyceros, *Gray, ibid.* p. 181 (no description); *Blyth, P. Z. S.* 1867, p. 842, figs. 20-23.
Panolia eldii, *Gray, Cat. Mam. &c. Nepal & Thibet B. M.* 1846, p. 34; *Blyth, J. A. S. B.* xxx, p. 193, xxxi, p. 334; *id. Cat.* p. 149; *id. P. Z. S.* 1867, p. 835, figs. 13-19; *id. Mam. Birds Burma*, p. 45; *Beavan, J. A. S. B.* xxxvi, pt. 2, p. 175.

Sangnai, Sangrai, Manipur; *Thameng*, Burmese.

Size moderate. Hair very coarse, shaggy in winter, thick and long about the neck in stags. Tail short. Skull elongate, frontal area very narrow; premaxillaries much shorter than in *C. duvauceli*. Horns with an extremely long curved brow-antler joining the beam in such a manner that the two form one continuous curve at right angles to the pedicel. There are frequently small

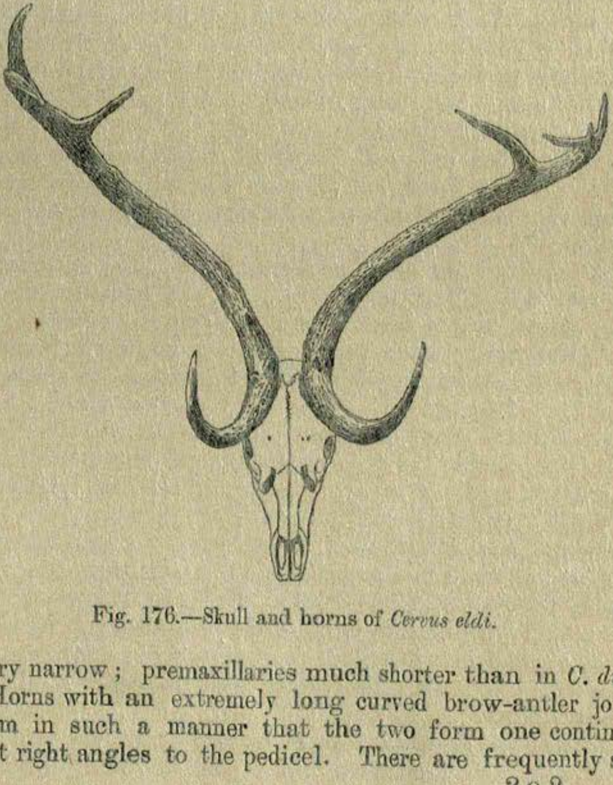

Fig. 176.—Skull and horns of *Cervus eldi*.

points on the upper surface of the brow-antler, and generally a prominent snag in the axil. The beam is unbranched for a considerable distance, generally more than half the length, and curved backwards, then outwards, and lastly forwards; towards the end it bears a number of small points from two or three to eight or ten or possibly more, as figured by Blyth (P. Z. S. 1867, *l. c.*). Curve of the two horns seldom exactly corresponding; those figured on the preceding page are typical, but perhaps with fewer branches than usual. Blyth shows that horns of this deer from Mergui and the Malay Peninsula are shorter and have commonly two or three vertical snags on the brow-antler. In the Siam form (*Panolia platyceros*) the upper part of the beam is flattened and bears several small points on its posterior edge.

Colour. Males in winter are said to be dark brown, almost black, in summer fawn-coloured; does are paler rufous fawn. The lower parts are white in summer, pale brown in winter. No caudal disk. A white mark above the eye is shown in Sclater's figure of the summer garb. The very young are spotted.

Dimensions. Stags about 45 inches, does 42, in height at the shoulders. I can find no other measurements. The basal length of a male skull is 11·75, extreme length 13·4, orbital breadth 5·4. Average horns measure about 40 inches from the tip of the brow-antler to the end of the horn; one of a pair in the British Museum is 54 long, or 35·5 from the burr to the tip; but 38·25 without the brow-antler is said to have been measured. Beavan says that males weigh 210 to 245 lbs., females about 140 lbs.: this is perhaps the weight of cleaned carcases.

Distribution. The valley of Manipur, and thence southwards in suitable localities throughout Burma and the Malay Peninsula (*Cantor*), also in Cambodia and Hainan, always in flat alluvial ground.

Habits. These have been described by Lieut. Eld (the discoverer of the species) and Captain Beavan. *C. eldi* inhabits grassy and swampy plains, and is usually seen in herds of from 10 to 50 or more; occasionally much larger numbers are found associating. They may enter the fringe of the forest in places for shade during the day, but they generally keep in the open plain. In some places in the Irrawaddy delta, and in Martaban, they are found in plains where, during the dry season, no fresh water is procurable. They are frequently seen in swamps, and feed on wild rice and other plants growing in such places.

The stags commence to shed their horns in June in Manipur; in Lower Burma the horns are lost about September. The rutting-season in Burma lasts from March till May; the young, usually one at a birth, are born in October and November. Males begin to acquire horns in the second year, and are in their prime when about seven years old. The sexes begin to breed at the age of eighteen months.

The call of the female is a short barking grunt, that of the male is lower and more prolonged, and is most frequently heard in the rutting-season.

367. **Cervus unicolor.** *The Sâmbar or Rusa Deer.*

Middle-sized *and* Great Axis, *Pennant, Hist. Quad.* p. 106 (1781).
Cervus unicolor *and* C. albicornis, *Bechstein, Allgem. Uebers. d. vierfüs. Thiere,* i, p. 112 (1799).
Cervus niger, *Blainv. Bull. Soc. Phil.* 1816, p. 76, *teste Blyth, J. A. S. B.* xi, p. 449.
Cervus hippelaphus, *Cuv. Oss. Foss.* ed. 2, iv, p. 40, pl. v, figs. 31–35, 42 (1823); *Duvaucel, As. Res.* xv, p. 157, pl. i (1825); *Elliot, Madr. Jour. L. S.* x, p. 220; *Blyth, J. A. S. B.* xi, p. 449, xx, p. 174; ? *Brooke, P. Z. S.* 1878, p. 903; *W. Sclater, Cat.* p. 179.
Cervus equinus, *Cuv. ibid.* p. 45, pl. v, figs. 37, 38, 46 (1823); *Sykes, P. Z. S.* 1831; p. 104; *Brooke, P. Z. S.* 1878, p. 901.
Cervus aristotelis, *Cuv. Oss. Foss.* ed. 3, iv. p. 503, pl. xxxix, fig. 10 (1825); *Blyth, J. A. S. B.* xi, p. 449; *Brooke, P. Z. S.* 1878, p. 901; *W. Sclater, Cat.* p. 176.
Cervus leschenaultii, *Cuv. ib.* p. 506, pl. xxxix, fig. 9 (1825).
Cervus (Rusa) hippelaphus, unicolor, aristotelis, *and* equinus, *Ham. Smith, Griffith's An. Kingd.* iv, pp. 105–112 (1827).
Cervus jarai, *Hodgson, Gleanings in Sc.* iii, p. 321, pl. xxi (1831); *id. J. A. S. B.* i, pp. 66, 115, pl. v.
Rusa jaraya, nepalensis, *and* heterocervus, *Hodgson, J. A. S. B.* x, p. 914 (1841) (no descriptions).
Axis pennantii, *Gray, List Mam. B. M.* p. 180 (1843).
Rusa aristotelis, *Gray, List Mam. B. M.* p. 179; *Blyth, Cat.* p. 150; *id. Mam. Birds Burma,* p. 45; *Jerdon, Mam.* p. 256; *Gilbert, Jour. Bomb. N. H. Soc.* iii, p. 224.
Rusa hippelaphus, *Kelaart, Prod.* p. 83.
Rusa equina, *Cantor, J. A. S. B.* xv, p. 271.

Sâmbar, Sâmar, H.; *Jarao* ♂, *Jarai* ♀, Nepal; *Mahá,* Terai; *Merú,* Mahr. of Ghats; *Ma-ao, Mauk,* Gond; *Sáram,* Ho-Kol; *Kadavé, Kadaba,* Can.; *Kennadi,* Tel.; *Kadumai,* Tam.; *Gona Rusa,* Cing.; *Gous, Gáoj, Bhalongi* ♀, E. Bengal; *Khát-khowa-pohu,* Assam; *Sacha,* Daphla; *Tshat,* Burmese; *Takhau, Hseukhau, Kheu,* Karen; *Rusa, Rusa-etam,* Malay.

The largest Indian deer. Ears large. Hair coarse. Neck and throat of the adult male covered with long hair forming an erectile mane. Muffle large. Orifices of infraorbital glands very large and capable of eversion. Tail moderate. Interdigital glands wanting, according to Hodgson. Molars markedly hypsodont, with small accessory columns. A deep lachrymal fossa; auditory bulla slightly inflated and rugose. Horns each normally with but three tines and very rarely bearing more, irregular points or sports being less common than in most deer; the brow-antler meets the beam at an acute angle; the two upper tines generally subequal in Indian heads, but very variable in form and proportion.

Colour almost uniform dark brown throughout, sometimes greyer, sometimes with a slight yellowish tinge, scarcely paler below. Females and young paler and more rufous than males. Chin, inside of the limbs near the body, lower surface of the tail, and inner part of the buttocks yellower, sometimes dull yellowish white. Young not spotted at any stage. Some old males are very dark-coloured, almost black or dark slaty grey.

Dimensions. Height at shoulder of males 48 to 56 inches, and it is said even more; length 6 to 7 feet, tail 12 to 13 inches, ears 7 to 8. Females are smaller. A male skull measures in basal length 14·2 inches, extreme length 15·7, orbital breadth 6·7. A very large stag killed in Cooch Behar is said to have weighed 700 lbs. (51 stone), smaller but still fine male animals about 560 ('Asian,' April 3rd, 1891, p. 3). Horns vary enormously; any over 35 inches in length are of good size, and such are seldom, if ever, seen out of India. The largest recorded measured 48 inches, but the girth at mid-beam was only 6; horns 35·5 and 38 inches in length have been found to have a girth of 8·25 inches halfway up the beam, and 8·5 has been measured in horns 41 inches long.

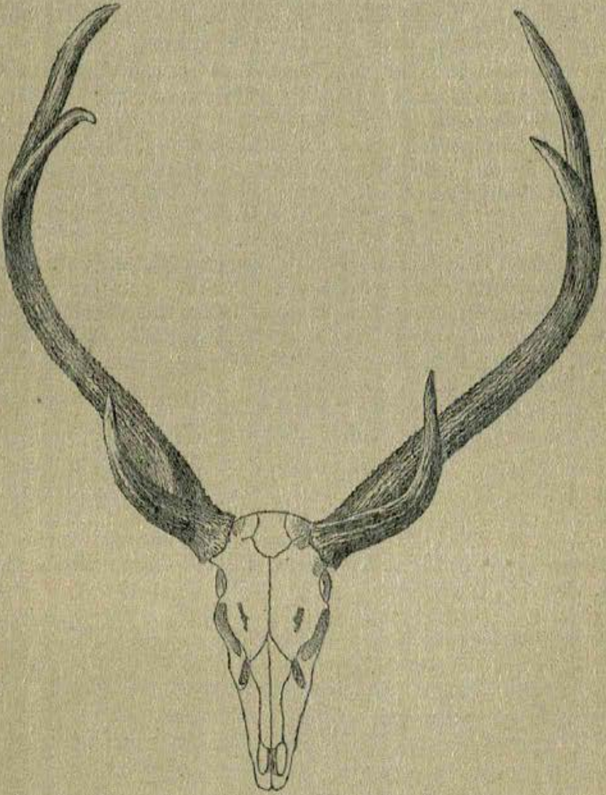

Fig. 177.—Skull and horns of *Cervus unicolor*. (From Forsyth.)

Distribution. Almost throughout the Oriental region wherever there is undulating ground or hilly country with forest, but the forms in some of the Malay Islands appear to be specifically distinct. The sámbar ascends the Himalayas in places to 9000

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or 10,000 feet, and is common on the summits of the ranges in Southern India and Ceylon. It is not common on alluvial flats, though it is occasionally found on them, at considerable distances from any hills. It is, of course, wanting in the treeless plains of the Punjab, Sind, and Western Rajputana.

Varieties and Nomenclature. This fine deer appears to have been first mentioned by Pennant, who described it as the middle-sized and greater Axis (*Cervus axis unicolor* and *C. axis major* of Kerr). To these forms the names of *Cervus unicolor* and *C. albicornis* were applied by Bechstein. Cuvier, in the second edition of his 'Ossemens Fossiles,' named different varieties *C. hippelaphus* and *C. equinus*, and two years afterwards added the names of *C. aristotelis* and *C. leschenaultii*, given to horns only. Why the name *C. aristotelis*, given to an abnormal horn, has been preferred for the Indian Sámbar it is difficult to say. The name *C. unicolor*, ememployed by Hamilton Smith, is preferable on account of both priority and suitability, being an appropriate term for the only Indian deer with unspotted young.

Continental forms of sámbar do not greatly vary in size, though some Malay Island varieties are very much smaller. Horns from the Himalayas, Assam, and Burma are inferior in size to those from Central India and Bengal. Moreover, whilst in Indian heads the two upper tines generally are nearly equal in length, in Burmese heads the inner tine is considerably shorter than the outer, and the brow-antler is much longer in proportion to the others, as in the Malay form usually called *C. equinus*. The name *C. hippelaphus* is by Brooke and others applied to a Malay variety in which the inner tine is the longer. But all the three names were by Horsfield and others used for varieties found in the Peninsula of India. Elliot showed that these passed into each other, and Blyth, correctly as I believe, united the Himalayan, Burmese, and Malay races with the Indian.

Habits. This is the woodland deer of South-eastern Asia generally, and is more widely and generally distributed than any other species. Although it does not shun the neighbourhood of man to the same degree as *Bos gaurus* does, it is only common in wild tracts of country. It comes out on the grass slopes where such exist, as in the Nilgiris and other hill-ranges, to graze, but always takes refuge in the woods. It is but rarely found associating in any numbers; both stags and hinds are often found singly, but small herds from four or five to a dozen in number are commonly met with. Its habits are nocturnal; it may be seen feeding in the morning and evening, but it grazes chiefly at night, and at that time often visits small patches of cultivation in the half-cleared tracts, returning for the day to wilder parts, and often ascending hills to make a lair in grass amongst trees, where it generally selects a spot well shaded from the sun's rays. It feeds on grass, especially the green grass near water, and various wild fruits, of which it is very fond, but it also browses greatly on shoots and leaves of trees. It drinks, I believe, daily, though

Sterndale doubts this; it certainly travels long distances to its drinking-places at times.

The rutting-season is about October and November in the Peninsula of India, but, according to Hodgson, in spring in the Himalayas. At that time sámbar collect in larger numbers, and the loud roaring call of the stags is often heard in the morning and evening and sometimes late at night. The period of gestation is eight months, and a single young one is generally born at a time. The horns are usually dropped in March in the Peninsula, and about April in the Himalayas, but all stags do not lose their horns at this time. I have shot them myself in the Central Provinces in April and May with fully developed horns; and Forsyth, who paid particular attention to this characteristic of the sámbar, not only insists upon the fact that stags with perfect horns may be found at all seasons, but declares that individual stags to his knowledge retained their horns for successive years.

The stag's call, already mentioned, is termed by McMaster a "loud and somewhat metallic-sounding bellow," whilst the hind's call, a sharper but fainter note, is described as a "faint grunting low" by the same authority, who has given an excellent account of this animal's habits in his 'Notes on Jerdon.' There is also a sharp snort or cry of alarm caused by the presence of a tiger or panther, or by the sight of man.

The speed of a sámbar is very moderate, and if found on ground where riding is possible, a rare event, any fairly good horse with a rider of moderate weight can catch either stag or hind. All species of *Cervus*, I believe, can be ridden down without much difficulty. I have heard of both spotted and hog deer being speared in favourable localities. Sámbar are usually driven by beaters, or stalked, but in Ceylon it was at one time the practice to hunt them with deer-hounds and kill them with a knife, as described in Sir S. Baker's 'Rifle and Hound in Ceylon.' They are very tenacious of life, and often take several bullets before they fall. Many are killed by tigers and wild dogs. The stags fight much amongst themselves, the brow-antler, as in all deer, being the principal weapon of offence, and the wound it inflicts has the reputation of being very deadly. The flesh of the sámbar is coarse, but well-flavoured, the marrow-bones and tongue being usually retained by sportsmen for themselves; but as most Hindoos will eat deer with antlers, the meat is seldom wasted in India, as that of wild cattle and pigs often is.

368. **Cervus axis.** *The spotted Deer.*

Cervus axis, *Erxl. Syst. Reg. An.* p. 312 (1777); *Elliot, Mad. Jour. L. S.* x, p. 221; *Blyth, J. A. S. B.* xi, p. 1202, xxii, p. 415; *Brooke, P. Z. S.* 1878, p. 907; *Ravenscroft, P. Z. S.* 1883, p. 465; *W. Sclater, Cat.* p. 181.

Cervus nudipalpebra, *Ogilby, P. Z. S.* 1831, p. 136.

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Axis major *and* minor, *Hodgson, J. A. S. B.* x, p. 914 (1841), no descriptions; xvi, pp. 691, 711; xvii, pt. 2, p. 486.
Axis maculata, *Gray, List Mam. B. M.* p. 178 (1843); *Kelaart, Prod.* p. 82; *Adams, P. Z. S.* 1858, p. 530; *Blyth, Cat.* p. 152; *Jerdon, Mam.* p. 260.

Chital, Chitra, Jhánk, H.; *Chatidah*, Bhágalpur; *Boro khotiya*, Beng., Rungpore; *Buriya*, Gorakhpur; *Lupi, Kars*, Gond; *Dárkár*, Korku; *Pústa*, Ho-Kol; *Sárung, Sáraga, Jati, Mikka*, Can.; *Dupi*, Tel.; *Pali-man*, Tam. Mal.; *Tic Muha*, Cing.

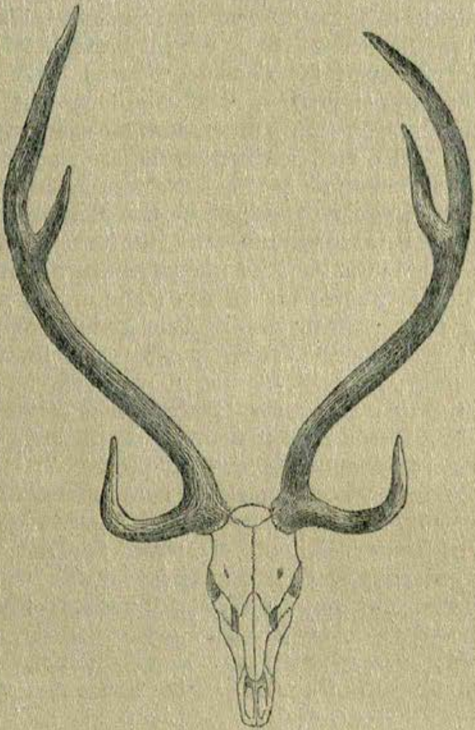

Fig. 178.—Skull and horns of *Cervus axis* (horns after Forsyth).

Size moderate. No mane. Molars very hypsodont. Muffle as in *C. unicolor*. Tail long, pointed. Interdigital glands in hind feet only (*Hodgson*). Upper canines generally wanting (Hodgson states that he has found them in both sexes). Horns normally with three tines, a brow-antler which joins the beam at rather less than a right angle, and two upper tines of which the outer is always much the longer. Sports or irregular points in the axil of the brow-tine very common; few fine horns are without them, but other additional points are rare.

Colour rufous fawn, spotted throughout the body with white at all seasons and all ages. A dark dorsal stripe from nape to end of tail, bordered by a single or double row of white spots on the back. Low down on the sides the white spots sometimes blend into a horizontal line. Chin and upper throat, belly, inside of limbs, and lower surface of the tail white. Head brownish unspotted, the face darker. Ears brown outside, white within. A melanoid variety indistinctly spotted occasionally occurs (*C. nudipalpebra*).

Dimensions. Height of males at shoulder 36 to 38 inches in Central and Northern India, length 4½ to 5 feet. A female measured 30 inches high, 53 long; tail with hair 12½, without 10. In Southern India the height is considerably less, 30 to 34 inches according to Jerdon. But an Anaimalai male measured by Hornaday was nearly 36 inches high, 62 long, and weighed 145 lb. Basal length of a large male skull 9·75, orbital breadth 4·7. Horns of the larger variety have been measured 38 and 38·75 inches long round the curve, with a girth of 4 at mid-beam and 5·75 at the base above the burr. Ordinary horns measure about 30 in length, but heads from Bengal and Southern India are generally smaller.

Distribution. The spotted deer is found nearly throughout India and Ceylon. It occurs at the base of the Himalayas, not, however, ascending the mountains beyond the lower spurs, from the neighbourhood of the Sutlej to Nepal, but not in Sikhim. It is not found in the Punjab plains, nor in Sind, and only to the eastward in Rajputana; it is wanting also in Assam and to the east of the Bay of Bengal, but common in the Sundarbans, apparently as far east as Mymensing (J. A. S. B. xxii, p. 415), throughout Bengal and Orissa, the N.W. Provinces, Central India, Mysore, Malabar, and Ceylon, in all suitable localities. It ascends the hills of S. India in places to about 3500 or 4000 feet.

Varieties. With the exception of the rare melanoid form already mentioned, the only variation, so far as I know, is in size. The spotted deer of Lower Bengal, Malabar, Southern India, and Ceylon are considerably smaller than those of the North-west and Central Provinces, and of the hills of Orissa and Vizagapatam. Hodgson proposed the name of *Axis minor* for the smaller race, and Jerdon was inclined to regard it as distinct, but there is now a general agreement that the two forms are merely local varieties.

Habits. The especial habitat of this deer, perhaps the most beautiful in form and coloration of the whole family, is amongst bushes and trees near water, and in bamboo-jungle. The spotted deer is found both in hilly ground and on alluvial plains. It never goes far from its drinking-places. So long as it has a wild tract of bush or ravines for shelter, it appears to care little for the neighbourhood of man. Many of its favourite haunts are in some of the most beautiful wild scenery of the Indian plains and lower hills, on the margins of rippling streams with their banks overgrown by lofty trees, or in the grassy glades that open out amidst the exquisite foliage of bamboo clumps. Spotted deer are thoroughly gregarious and associate at all times of the year in herds, sometimes of several hundreds. They are less nocturnal than sámbar, and may be found feeding for three or four hours after sunrise, and again in the afternoon for an hour or two before sunset. They generally drink between 8 and 10 o'clock in the morning, the time varying with the season of year, and repose during the day in deep shade. They swim well, and take readily to water. They both graze and browse.

There is, I believe, much variation in the rutting-season, which, according to Hodgson, begins in September. It is generally in the cold season in Northern India, but I am under the impression that young fawns are born almost throughout the year. Certainly there is great irregularity as to the period of dropping the horns, and bucks with perfect antlers may be found at all seasons. The call of the spotted deer is a peculiar, loud, hoarse barking sound, easily recognized but difficult to describe. This deer also utters a shrill alarm cry. The period of gestation is 8 months (P. Z. S. 1863, p. 230), or 6 according to Hodgson (J. A. S. B. xvi, p. 691). The flesh is dry as a rule, but if kept till tender is excellent.

369. **Cervus porcinus.** *The Hog-deer.*

Cervus porcinus, *Zimm. Spec. Zool. Geog. Quad.* p. 532 (1777); *McClelland, P. Z. S.* 1839, p. 150; *Hutton, J. A. S. B.* xv, p. 150; *Brooke, P. Z. S.* 1878, p. 902; *W. Sclater*, p. 178.

Hyelaphus porcinus, *Sundevall, Kong. Vet. Ak. Handl.* 1844, p. 181; *Adams, P. Z. S.* 1858, p. 530; *Blyth, Cat.* p. 153; *id. Mam. Birds Burma*, p. 45.

Axis oryzus, *Kelaart, Prodr.* p. 83 (1852); *Blyth, J. A. S. B.* xxiii, p. 217.

Axis porcinus, *Jerdon, Mam.* p. 262.

Párá, H. (also Sindhi and Punjábi); *Dodar*, Rohilcund; *Khar laguna*, Nepal Terai; *Nutrini haran*, Beng.; *Wil-muha*, Cing.; *Darai* or *Dayai*, Burmese.

Size small. Legs shorter in proportion. Tail rather long. Frontal region of skull narrow. No upper canines. Horns small, on longish pedicels. Each horn with 3 tines, the brow-antler meeting the beam at an acute angle, outer upper tine exceeding the inner.

Colour. Brown, more or less rufous or yellowish, the hairs with pale tips, producing a minutely speckled appearance. Lower parts paler. Ears white inside, and tail white beneath. In summer the fur is paler, more rufous and more or less spotted with pale brown or white. The spots are probably not always developed, and they soon disappear: they are sometimes limited to one or two rows on each side of a dark dorsal stripe. Some doubt has been expressed as to whether adults are ever spotted, but I watched the assumption of the spotted summer garb for 2 or 3 years in several adults kept in the Calcutta Zoological Gardens. The young up to about six months old are spotted throughout the body.

Dimensions. Height at shoulder about 24 inches; length from muzzle to root of tail 42 to 44, tail with hair 8. A male skull measures 8·6 in basal length by 4·1 in orbital breadth. The horns are generally small, and do not often exceed 10 or 12 inches in length. The longest recorded are a little over 20 inches long with a girth at mid-beam of 3·5.

Distribution. In the Indo-Gangetic plain everywhere from Sind and the Punjab to Assam. The hog-deer is common in the Terai, but never ascends the hills. It is found also in Sylhet and throughout Burma to Tenasserim in alluvial flats. It may range some distance into the Peninsula along the course of the Gangetic tributaries like the Soane; but although it is said by Forsyth to be found in the Central Highlands east of Mandla, and by Ball to have been seen by him distinctly in Jeypore near Vizagapatam, I think the existence of the animal in both localities needs confirmation. As a rule, it is certainly not found in the Peninsula of India; reports of its occurrence in parts of the Bombay and Madras Presidency being due to the use of the term Hog-deer for *Tragulus meminna* and perhaps for *Cervulus muntjac*, on account of their bearing tusks. Some true hog-deer occur in Ceylon, but are confined, as I learn from Mr. Hugh Nevill, to a small area between Matura and the Kaltura River, and have almost certainly been introduced.

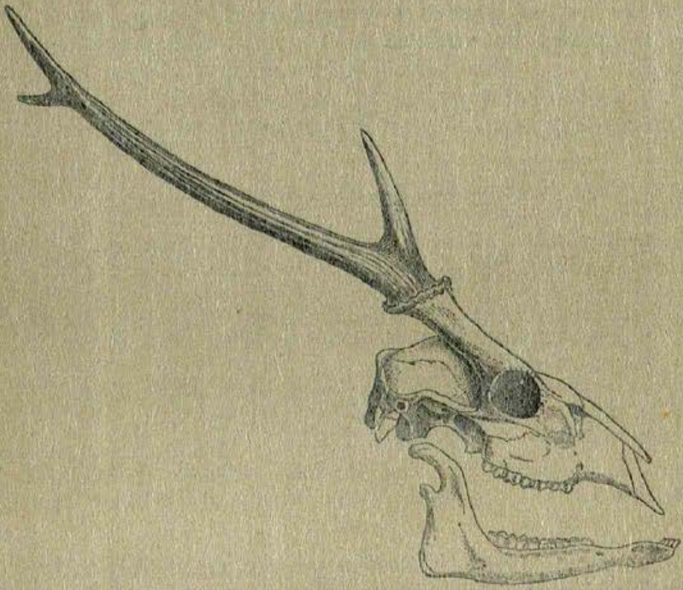

Fig. 179.—Skull and horn of *Cervus porcinus.*

Habits. The hog-deer is an inhabitant of alluvial plains, and is almost if not quite restricted to them. It abounds in some of the grass-jungles, keeping as a rule to grass of moderate height, mixed with tamarisk and other bush, rather than to the masses of grass 12 to 30 feet in height that form the favourite haunt of the buffalo and rhinoceros. It is sometimes found amongst high trees, but not so often as on grassy plains. Hog-deer are not

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gregarious, it being rare to find more than two or three together, though several may be met with in the same small tract. As a rule, however, individuals of both sexes are solitary. These animals are somewhat ungainly in their movements; they run awkwardly, with the head low. As already stated, they have frequently been speared, but generally give a good run before being caught; they are naturally more often found on ground suitable for riding than other Indian deer. Generally they are shot off elephants. The rutting-season is in September and October according to Jerdon. The period of gestation is 8 months (P. Z. S. 1863, p. 230). The bucks drop their horns generally in April.

Subfamily MOSCHINÆ.

No horns in either sex. A gall-bladder present, as in the *Bovidæ*. A simple orifice to the lachrymal canal, situated just within the anterior margin of the orbit. Hemispheres of brain but slightly convoluted. Cotyledons of placenta arranged in a peculiar linear order. A single genus.

Genus **MOSCHUS**, L. (1766).

Upper canines in both sexes, greatly developed in males and projecting considerably beyond the mouth. Skull very similar in form to that of *Cervus*. Outer metatarsals wanting; the distal extremities of the outer metacarpals present; all the outer toes

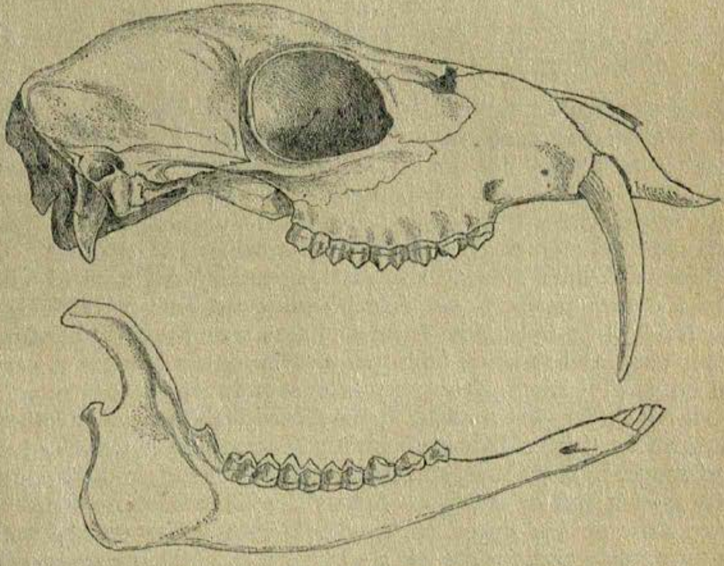

Fig. 180.—Skull of *Moschus moschiferus*.

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have well-developed phalanges. No infraorbital or interdigital glands. A peculiar sac-like gland in the male, situated beneath the skin of the abdomen, immediately in front of the preputial aperture. This is the musk-gland. Campbell (J. A. S. B. vi, p. 118) and Hodgson (*op. cit.* x, p. 795) have described another gland with an elliptical orifice on each side beneath the tail, also peculiar to the male. Vertebræ: C. 7, D. 14, L. 5, S. 5, C. 6.

The anatomy has been described by several writers, especially Pallas (Spic. Zool. xiii, 1779), Campbell and Hodgson *ll. c.*, Flower (P. Z. S. 1875, p. 159), and Garrod (P. Z. S. 1877, p. 287).

Several species have been proposed on account of differences in coloration, but these distinctions appear due to individual variation. Recently Büchner has described an additional species from Kansu, east of Tibet, as *M. sifanicus*.

370. **Moschus moschiferus.** *The Musk-deer.*

Moschus moschiferus, *L. Syst. Nat.* i, p. 91 (1766); *Hutton, J. A. S. B.* vi, p. 935; *Hodgson, J. A. S. B.* xvi, p. 693, xvii, pt. 2, p. 486; *Adams, P. Z. S.* 1858, p. 528; *Blyth, Cat.* p. 157; *Jerdon, Mam.* p. 266; *A. Milne-Edw. Ann. Sc. Nat.* (5) ii, p. 154, pl. iv, fig. 1; *id. Rech. Mam.* p. 176, pls. xix, xx; *Blanford, J. A. S. B.* xli, pt. 2, p. 39; *Lydekker, J. A. S. B.* xlvi, pt. 2, pp. 286, 287, xlix, pt. 2, p. 4; *Scully, P. Z. S.* 1881, p. 209; *W. Sclater, Cat.* p. 172.

Musk-deer, *Hodgson, Gleanings Sc.* iii, p. 320, pl. xxi (young).

Moschus chrysogaster, leucogaster, *and* saturatus, *Hodgson, J. A. S. B.* viii, p. 203, xi. p. 285.

Kastura, Múshk, H.; *Ráos, Rons,* Kashmir; *Lá, Láwa,* Tibetan; *Ribjo,* Ladak; *Bena, Masak nába,* Garhwál and Kumaun.

Hair of peculiar texture—long, coarse, brittle, minutely wavy, and composed of a substance resembling pith. Limbs long, the hinder considerably the longer. Hoofs narrow, pointed; lateral hoofs greatly developed. Ears large. Tail very small, glandular, and marked with a terminal tuft in males, hairy in females. The canines in the male are frequently 2 to 3 inches in length.

Colour rich dark brown, more or less speckled and mottled with grey, the hairs having a subterminal white ring and blackish tips. The basal three-fourths or more of the hair on the body is white. Lower parts and inside of limbs paler; chin, inner borders of ears, and inside of thighs whitish; a white spot in some (the young?) on each side of the throat. Some individuals are paler, others yellowish in tint. Hodgson's variety *chrysogaster* is described as bright sepia-brown above, sprinkled with golden red, and the lower parts golden red or orange. Adams describes another form as "very dark on the upper parts with black splashes on the back and hips, underparts white or a dirty white." This corresponds to Hodgson's *leucogaster*. Others, he says, "are of a yellowish white all over the upper parts, with the belly and inner sides of the thighs white." Jerdon mentions a Kashmir variety with grizzled grey spots in lines on the back. The young are spotted with white, or yellowish white; those from Kashmir are much paler in colour than Eastern Himalayan individuals.

Dimensions. Height of male at shoulder about 20 inches, at croup about 22; length, nose to rump, 36; tail without hair 1½ to 2; ear 4: weight of a female about 20 lbs. A male skull measures 5·15 in basal length, 2·7 in breadth across the orbits.

Distribution. Throughout the Himalayas as far west as Gilgit, at elevations exceeding 8000 feet (in Sikhim in the summer above 12,000), in forest and brushwood. Also in Tibet and other parts of Central Asia as far north as Siberia.

Habits. The musk-deer is a solitary animal, more than two being seldom if ever seen together. It frequents wooded slopes, often very steep, and, as Kinloch says, resembles a hare in its habits, making a "form" in which it remains throughout the day, and moving about to feed in the mornings and evenings. It is very active and surefooted, its large lateral hoofs apparently giving it the means of holding on to slippery and precipitous rocks, and it progresses by a series of bounds, sometimes of great extent. It is by no means shy where it has not been much hunted.

The food of the musk-deer is, by Adams, said to consist of grass and lichens, by Kinloch of leaves and flowers. This animal's fur is admirably adapted as a defence against cold. According to Adams, no cry has been observed, even in the rutting-season; the only sound this animal has been known to make is a series of harsh screams that it utters when captured.

The breeding-habits were observed by Hodgson in a pair kept in captivity at Katmandu. The rutting-season was in January, the period of gestation about 160 days, and a single young one was born in June. Two are sometimes, but not usually, produced; the young procreate before they are a year old.

The musk, the contents of the abdominal gland, is only developed at the rutting-season, and is a brown soft mass with a peculiar well-known odour. An ounce is about the average produce of one animal. Many musk-deer are snared in nooses, others shot to secure the "musk-pod," which is an article of commerce. The flesh of the animal is excellent, and free from any musky flavour.

TRAGULINA.

Family TRAGULIDÆ.

This being the only family of the present section, the characters may be given under one heading. The dentition is i. $\frac{0}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$, as in most *Cervidæ*. The fibula is complete. There are four toes, with fully developed phalanges and metapodials on all feet, the middle metapodials generally confluent. Navicular, cuboid, and ecto-cuneiform bones of tarsus united. The members of this section are true ruminants, but the stomach is composed of only three distinct compartments, the manyplies or third cavity of the Pecora being rudimentary. Placenta diffused.

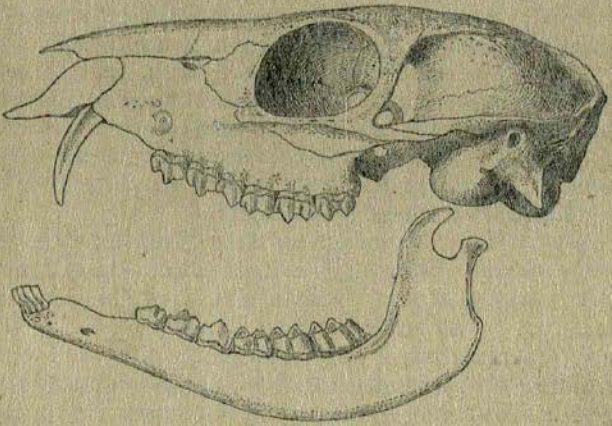

Fig. 181.—Skull of *Tragulus meminna* ♂, × $\frac{3}{4}$.

The *Tragulidæ* are small animals with very slender limbs and high hind-quarters, inhabiting forests. Of the only two living genera one, *Dorcatherium* (*Hyomoschus*), is West-African, the other, *Tragulus*, is Oriental. The type is less specialized than that of the *Pecora*, and it is not surprising to find many extinct forms of *Tragulina* in the Upper Eocene and Miocene of Europe and America, whilst in India two species of *Dorcatherium* (now peculiar to Africa) and one of *Tragulus* have been described from the Pliocene Siwaliks.

Genus **TRAGULUS**, Brisson (1756), partim.

Syn. *Meminna*, Gray.

Size small or very small. Metapodials confluent. A large muffle occupying the terminal portion of the muzzle. No infraorbital, interdigital, or inguinal glands. Skull elongate and compressed anteriorly; occiput narrow. Brachydont and selenodont; premolars with a pointed triangular crown, the profile becoming almost tricuspid with age; upper canines in males long, exserted, short in females. Mammæ 4. Hair in all species fine and close.

Synopsis of Indian, Ceylonese, and Burmese Species.

a. Body spotted; chin and throat hairy	*T. meminna*, p. 555.
b. Body not spotted; skin between rami of mandible naked.	
a'. Larger; hind foot and tarsus 5·6 to 6 inches	*T. napu*, p. 557.
b'. Smaller; hind foot and tarsus 4·4 to 5 inches	*T. javanicus*, p. 556.

371. **Tragulus meminna.** *The Indian Chevrotain or Mouse Deer.*

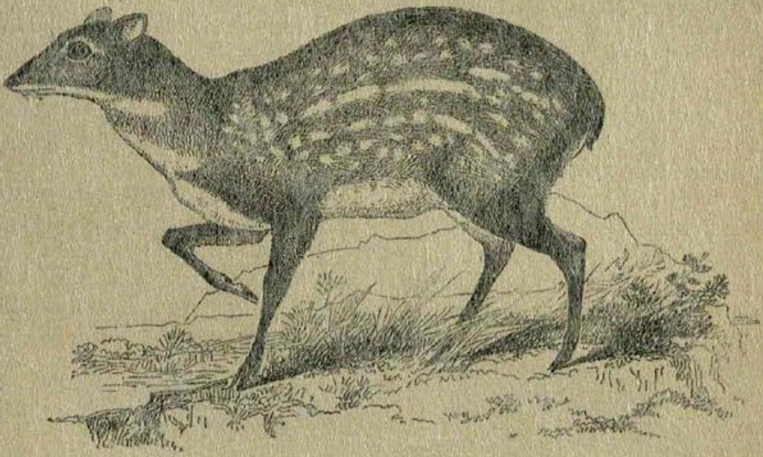

Fig. 182.—*Tragulus meminna.*

Moschus meminna, *Erxl. Syst. Regn. An.* p. 322 (1777); [*Sykes, P. Z. S.* 1831, p. 104; *Elliot, Mad. Jour. L. S.* x, p. 220; *Tickell, Calc. Jour. N. H.* i, p. 420; *Blyth, J. A. S. B.* xi, p. 96.

Meminna indica, *Gray, List Mam. B. M.* 1843, p. 172; *Kelaart, Prod.* p. 81; *Blyth, Cat.* p. 155; *id. P. Z. S.* 1864, p. 483; *Jerdon, Mam.* p. 269.

Tragulus meminna, *A. Milne-Edwards, Ann. Sci. Nat.* (5) ii, p. 160, pl. iii, fig. 2, pl. x; *W. Sclater, Cat.* p. 189; *Thomas, P. Z. S.* 1891, p. 385.

Pisura, Pisora, Pisai, H., Mahr.; *Jitrai haran*, Beng.; *Gandwa*, Uria; *Yar*, Ho-Kol; *Kuru-pandi*, Tel.; *Kuram-pani*, Tam.; *Kúr-pandi*, Can.; *Walmuha*, Cing.

No naked glandular area on throat. Tarsus hairy all round, except behind close to the hock. Tail short.

Colour. Upper parts brown, darker or paler, minutely speckled with yellow; the hairs brown at the base, black towards the end, with a yellow ring a short distance from the tip. Sides spotted with white or buff on a brown ground, the spots elongate and passing into longitudinal bands. Lower parts white; throat with 3 white stripes, one in the middle pointed in front, and an oblique one on each side.

Dimensions. Height at shoulder 10 to 12 inches, length from nose to base of tail 18 to 22 inches, tarsus and hind foot about 5·3, tail 1 to 1·5; weight 5 to 6 lb. A good-sized male skull from the Shevroy hills measures 4·5 in extreme, and 3·85 in basal length, and 2 in zygomatic breadth.

Distribution. Ceylon and Southern India in forest at elevations below 2000 feet, extending northwards to Orissa, Chutia Nágpur, and the Eastern Central Provinces; also along the Western Gháts to north of Bombay. I have never heard of this animal in Bengal proper, Behar, the North-west Provinces, Rajputana, the Bombay Deccan away from the Western Gháts, Berar, nor the Central Provinces west of Jubbulpore, Seoni, and Nágpur (Sterndale has recorded its occurrence near Seoni). Hodgson included it in his list of Nepal mammals, but appears never to have obtained a specimen, though Blyth refers to a Nepalese specimen in his Catalogue. I think the occurrence of this species in Northern India requires confirmation. If it occurs, it must be very rare. Jerdon also questioned its existence to the northward.

Habits. A good account is given by Tickell. He says this species "is found throughout the jungly districts of Central India (*i. e.* Chutia Nágpur), but from its retired habits is not often seen. It never ventures into open country, but keeps among rocks, in the crevices of which it passes the heat of the day, and into which it retires on the approach of an enemy. In these the female brings forth her young, generally two in number, at the close of the rains or the commencement of the cold season. The male keeps with the female during the rutting-season (about June or July), at other times they live solitary."

Like all the *Tragulidæ* this animal has a peculiar walk on the tips of its hoofs, which gives the legs a rigid appearance, and there is a common idea that it has no knee-joints. It is timid, but gentle and easily domesticated, and has bred in confinement. The only sound it has been observed to utter is a feeble bleat. It is crepuscular in its habits.

372. **Tragulus javanicus.** *The little Malay Chevrotain.*

Moschus javanicus, *Gmelin, Syst. Nat.* i, p. 174 (1788).

Moschus kanchil, *Raffles, Tr. L. S.* xiii, p. 262; *Gray, P. Z. S.* 1836, p. 64.

Tragulus kanchil, *Gray, List Mam. B. M.* p. 173; *Cantor, J. A. S. B.* xv, p. 268; *Blyth, J. A. S. B.* xxvii, p. 276; *id. Cat.* p. 156; *A. Milne-Edw. Ann. Sci. Nat.* (5) ii, pp. 111, 159, pl. ii, fig. 3, pl. ix; *Blyth, P. Z. S.* 1864, p. 483; *id. Mam. Birds Burma*, p. 44; *Thomas, P. Z. S.* 1886, pp. 72, 79; *W. Sclater, Cat.* p. 189.

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Tragulus javanicus, *A. Milne-Edw. t. c.* pp. 103, 157, pl. ii, fig. 1; *Blyth, P. Z. S.* 1864, p. 483; *Thomas, P. Z. S.* 1891, p. 385.
Tragulus pelandoc, *Blyth, J. A. S. B.* xxvii, p. 277; *id. Cat.* p. 156.

Yun, Burmese; *Kanchil, Pelandoc*, Malay.

A naked glandular area beneath the chin, between the rami of the mandible; tarsus naked behind throughout, carpus almost naked behind. Tail long.

Colour. Above brown, more or less rufous. Back in old individuals nearly black, but always more or less mixed with rufous or yellow, from some of the hairs having a yellow ring near the end. Hair at base light brown. Sides paler; nape and upper surface of neck almost or quite black, contrasting with the light brown of the sides. Lower parts white, variously mixed with light rufous and usually with a median narrow brown or rufous line throughout the breast, in front of this is a brown cross band and on the fore neck an arrowhead-like brown mark, sometimes imperfect, with three white stripes, one median, within the arrow-head, the other two diverging, one on each side, outside of it; the last two joining on the throat. Rump rufous, inside of thighs and intermediate space always white; tail rufous-brown above, white below.

Dimensions. The largest adults measure: nose to root of tail 18·5 inches, tail 3 (*Cantor*), tarsus and hind foot 4·4 to 5. Basal length of a male skull 3·4, extreme length 3·95; zygomatic breadth 1·9.

Distribution. Malay Peninsula and Islands, extending as far north as Yay in Tenasserim, also to Cambodia and Cochin China. This species is common in Sumatra and Java.

Habits. Very similar to those of *T. meminna.* This chevrotain inhabits dense thickets and is said to be very abundant in the mangrove-jungle along the coast of Tenasserim and the Malay Peninsula. It is timid and very delicate, though it is easily tamed, and occasionally has been known to breed in confinement. It produces one or two young at a time. Except the Royal Antelope, *Nanotragus pygmæus*, the present is the smallest living Ungulate.

373. **Tragulus napu.** *The larger Malay Chevrotain.*

Moschus javanicus, *Raffles, Tr. L. S.* xiii, p. 262; *Gray, P. Z. S.* 1836, p. 64; *nec Gmelin.*
Moschus napu, *F. Cuv. Hist. Nat. Mam.* pl. 329 (1822).
Tragulus javanicus, *Gray, List Mam. B. M.* 1843, p. 173; *Cantor, J. A. S. B.* xv, p. 269; *Blyth, J. A. S. B.* xxvii, p. 277; *id. Cat.* p. 155.
Tragulus fuscatus, *Blyth, J. A. S. B.* xxvii, p. 278.
Tragulus napu, *A. Milne-Edw. An. Sci. Nat.* (5) ii, pp. 106, 158, pl. ii, fig. 2, pl. viii; *Blyth, P. Z. S.* 1864, p. 483; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 166; *Thomas, P. Z. S.* 1886, p. 71, 1891, p. 385; *W. Sclater, Cat.* p. 190.

Napu, Malay.

A naked tract on the throat, the tarsus naked behind, and the tail long as in *T. javanicus.* Size larger.

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Colour. Upper parts yellowish or rufous-brown, sides greyer. Hair on back light brownish orange with black tips, no subterminal pale ring. On the sides the basal portion of the hair is whitish. Forehead and nape blacker, but the borders of the black area ill-defined. Lower parts white, generally a brown median line on the breast, the chest and lower abdomen white and an intermediate tract brownish. Throat and fore neck brown, with 5 white bands more or less distinct, a median band on the chest and two oblique lines on each side in front on the throat. The white lines often become blended together. Rump rufous; tail brown above, white below.

Dimensions. Height 13 inches, nose to root of tail 28, tarsus and hind foot 5·6 to 6, tail 5. I have been unable to obtain the measurements of an adult skull; those of the figure in Milne-Edwards's paper are: extreme length 4·5 inches, basal length 4, breadth 1·9, but these are probably small.

Distribution. The Malay Peninsula, extending north into Southern Tenasserim, and south to Sumatra, Java, and Borneo. This species was obtained at Bankasún in S. Tenasserim by Mr. W. Davison.

Habits. So far as is known similar to those of the other species, but the larger chevrotain is much less common in the Malay Peninsula than *T. javanicus.*

The *Tylopoda*, or Camels and Llamas, form a separate section of the ruminant Artiodactyle Ungulates. They differ from other ruminants in dentition, the full number of upper incisors being present in the young and the outermost being persistent throughout life. The canines are present in both jaws, and the lower canines are distinct from the long procumbent and spatulate incisors. The molars are selenodont and hypsodont, but one or more of the anterior premolars is usually detached from the series and pointed. Only two digits, the third and fourth, are present in each foot, and there are no true hoofs, the ungual phalanges bearing nails and the sole of the foot consisting of a broad fleshy pad. There are no horns. There is no distinct third compartment of the stomach or manyplies, the interior of the rumen or paunch has no villi on the surface, and both it and the second compartment have within their walls large pouches or cells in which water can be retained. The placenta is diffuse.

There are two living genera, *Camelus* and *Lama* (*Auchenia*), the latter South American. Only two species of camel exist—*Camelus bactrianus*, the two-humped camel, found tame in Central Asia; and *C. dromedarius*, the single-humped camel, so extensively employed in South-western Asia and Northern Africa. This is the animal of which large herds are kept in North-western India. It is unknown in the wild state, and although Bactrian Camels have been found wild by Prejvalski and others in the deserts east of Yárkand, there is but little doubt that these wild individuals are descended from tame ancestors. Fossil remains of camels belonging to two extinct species are found in the Pliocene Siwaliks of Northern India.

SUINA.

Molars bunodont, bearing, when unworn, cone-like tubercles, and exhibiting when worn a pattern not arranged in crescents. Not ruminant. Third and fourth metapodials not completely united to form a cannon-bone (fig. 157 *c*, p. 480). Upper incisors present.

Only one family is represented in India.

Family SUIDÆ.

An elongate snout, terminating in an expanded, truncated, nearly naked, flat disk containing the nostrils. Feet narrow; four completely developed toes in each, the hoofs of the outer two not reaching the ground in the ordinary walking position. Teeth variable in number. Incisors rooted. Upper canines curving more or less outwards and upwards. Stomach simple. A cæcum present.

The family of the pigs is distributed throughout the greater part of Europe, Asia, and Africa. These animals are amongst the least specialized of living Ungulates and are represented by a great number of extinct species, extending back to the Miocene and Upper Eocene. In Indian Pliocene and Pleistocene beds six or seven species of *Sus* alone are found, one of them the largest of known pigs, besides species of *Hyotherium*, *Hippohyus*, &c. In addition to members of the *Suidæ*, numerous forms are met with that tend to unite the non-ruminant *Suina* with the ruminant *Pecora*, especially pigs with selenodont molars (*Anthracotherium* &c.). Amongst the most remarkable pig-like forms is *Tetraconodon*, an animal about the size of a tapir with enormous conical premolars.

The Indian living species belong to the typical genus.

Genus **SUS**, L. (1766).

Syn. *Porcula*, Hodgson (1847).

The complete dentition of the Eutheria is present :—i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{3-3}{3-3}$. Upper incisors diminishing rapidly in size from the median pair to the outer. Lower incisors long, narrow, projecting almost horizontally. Canines (tusks) greatly developed in males, rootless, both upper and lower curved outwards and projecting from the mouth in males, the upper turned upwards. Teeth of molar series increasing in size and complexity from the

GSL

first to the last, first lower premolar separated from the second by an interval. Last molar nearly or quite as long as the two preceding it together. Vertebræ: C. 7, D. 13–14, L. 6, S. 4, C. 20–24.

Skull elongate, the occipital crest greatly elevated, so that in the profile the occiput makes an acute angle with the line of the face. Nasals very long and narrow; a peculiar prenasal bone.

True pigs are found throughout the Oriental region and the temperate portion of the Palæarctic, and are represented by the subgeneric form *Potamochœrus* in Africa and Madagascar. Three species occur within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

Large; height at shoulder 30 to 40 inches....	*S. cristatus*, p. 560.
Small; height about 20 inches	*S. andamanensis*, p. 562.
Very small; height about 10 inches..........	*S. salvanius*, p. 563.

374. **Sus cristatus.** *The Indian wild Boar.*

Sus cristatus, *Wagner, Münch. gel. Anz.* ix, p. 535 (1839); *Blyth, Mam. Birds Burma*, p. 43; *W. Sclater, Cat.* p. 193.

Sus scrofa, *Sykes, P. Z. S.* 1831, p. 104; *Elliot, Mad. Journ. L. S.* x, p. 219; *Blyth, Cat.* p. 139; *Blanford, J. A. S. B.* xxxvi, p. 197 (*nec Linn.*).

Sus indicus, *Gray, List Sp. Mam. B. M.* p. 185 (1843); *Cantor, J. A. S. B.* xv, p. 261; *Kelaart, Prod.* p. 78; *Jerdon, Mam.* p. 241.

Sus affinis, *Gray, List Ost. Sp. B. M.* (1847), p. 71 (no description).

Sus zeylonensis, *Blyth, J. A. S. B.* xx, p. 173; xxi, p. 351.

Sus bengalensis, S. indicus, *and* S. zeylanensis, *Blyth, J. A. S. B.* xxix, p. 105.

Suar, Barha, Bad or *Bura jánwar*, H.; *Dúkar*, Mahr., Guz., Sind.; *Hikh*, Baluch; *Gúráz, Kuk*, P.; *Pandi*, Tam., Tel., &c.; *Katu-pani*, Tam.; *Paddi*, Gond; *Bir Sukri*, Ho-Kol; *Kis*, Rájmehál hill tribes; *Handi, Mikka, Jevadi, Kari-játi*, Can.; *Sukaram*, Mal.; *Walura*, Cing.; *Banel*, Nepal.; *Ripha, Phák*, Bhotia; *Sarao*, Daphla; *Bali, Techim*, Mishmi; *Sniang*, Khási; *Vák*, Gáro; *Omar, Hono*, Kachári.; *Kubak, Tharo, Kashag, Mengi, Vák*, Nága; *Eyeg*, Abor: *Mu*, Khámti; *Ok*, Manipur; *Vu*, Kuki; *Vhu*, Aka; *Wa*, Singpho; *Tau wet*, Burm.; *Kalet*, Talain; *Hto*, Karen; *Mu*, Shan; *Bábi útan*, Malay.

A crest of lengthened black bristles from the nape along the back. Hair coarse and bristly throughout, thin on the sides, and still thinner below. No woolly underfur. Tail extending nearly to hocks, scantily haired except at the tip, which is compressed and fringed on each side. Ears thinly clad externally, more thickly within. The last lower molar always, and the last upper molar generally, longer than the two preceding molars together. Mammæ 6 pairs.

Colour. Black, more or less mixed with rusty brown or whitish; young animals browner, old animals greyish. The young, when first born, are light fulvous brown, with longitudinal stripes of dark brown.

Dimensions. Adult animals measure about 5 feet from nose to vent; tail 8 to 11·5 in., with hair a foot or more; ear 5·5 in.

Height 28 to 36 inches at the shoulder; according to Simson, one of the largest boars he ever killed (in Bengal, where some are of great size) was just under 38 inches high. Males are larger than females.

Basal length of a large boar's skull 13·75 inches, zygomatic breadth 7·3. Weight of adults from about 200 to considerably over 300 lb. (4 maunds). The lower tusks in a large hog are said to have measured 12 inches in length, including the portion imbedded in the jaw, but they rarely exceed 9.

Distribution. Throughout India, Ceylon, and Burma; on the Himalayas to a considerable elevation. Capt. Baldwin says he has seen their tracks at 15,000 feet.

Varieties. Blyth at one time divided the wild pigs of India into 3 species, distinguished by the form of the skull, and especially by the breadth and convexity of the frontal plane in the parietal region, the skull of the large Bengal type being broadest and most convex, and a Ceylonese skull narrowest. There appears, however, to be no constant distinction, although large skulls from the Gangetic plain exhibit the peculiarities noticed by Blyth. The other characters mentioned by him are not, I believe, peculiar to the Bengal race. Some years ago I called attention (J. A. S. B. xxxvi, p. 197) to the occurrence in forest and bush-jungle of whole herds of brown pigs, and to my having seen a large solitary hog of the same colour, a dull brown, quite different from the usual blackish tint. This was on the Nerbudda, south-east of Indore; but I have seen pigs of the same colour in various parts of India, including, I think, Western Bengal. The same variation has been noticed by Forsyth.

Sus cristatus is distinguished from the European wild boar, *S. scrofa*, by its much more developed crest or mane, and by the proportionally greater size and complexity of the last molar in each jaw. The Indian pig is higher, and much more thinly covered with hair. According to Jerdon the tail is more tufted and the malar beard more marked, perhaps owing to the hair in general being less shaggy. The wild pigs of Baluchistan and Afghanistan may be *S. scrofa*, as are, I think, those of Persia and Mesopotamia.

The tame pig of India is doubtless derived from the wild animal and probably breeds with the latter in places. I have more than once seen a litter of tame young pigs striped; and as this peculiarity is wanting in tame animals generally, such litters may have been the produce of tame sows by wild boars.

According to Blyth the Tenasserim wild pig is a much smaller form, adult skulls being one-fifth less in linear dimensions.

Habits. The Indian wild boar is found during the day in high grass or bushes, sometimes in forest and often in high crops—the females and young as a rule associating in herds or "sounders" usually of ten or a dozen, and rarely exceeding about twenty individuals, whilst the adult males keep apart. They roam about and feed on various vegetable substances in the morning and evening. They are partial to marsh, and feed largely on the roots of plants growing in swampy places—especially, according to

Jerdon, on those of a sedge that is found on the edges of tanks. They turn up the soft ground with their snouts when rooting about for food, and leave marks easily recognized. No animals are more destructive to crops. The food of wild pigs is, however, not absolutely restricted to vegetables; they have several times been observed to feed on dead animals, and Mr. Peal states that in Assam they dig out and eat the fish that bury themselves in mud during the dry season. Wild pigs feed much at night, but they are less nocturnal in tracts where they can feed without disturbance after sunrise.

The speed of a wild pig is considerable, but not for a long distance; on any practicable ground either boar or sow may be caught by a fair horse within a moderate distance. Spearing hogs, or "pigsticking" as it is commonly called in India, is unquestionably the finest sport in the country, and owes its excitement to the circumstance that, as Sterndale justly remarks, a boar is perhaps the most courageous of all wild animals, and generally fights to the death, receiving spear after spear and charging horseman after horseman with reckless gallantry. Several instances are on record of desperate fights between a large boar and a tiger, and in not a few the tiger has been killed. Sterndale mentions two cases within his own knowledge. McMaster relates an instance of a boar charging, knocking over, and ripping a camel, and occasionally even elephants are attacked. Yet a boar seldom makes an attack without provocation. There is much difference in both the endurance and courage of hogs in different parts of India, the large heavy pig of Bengal having less taste for running and more for fighting than the more lightly built animal of the Deccan or the Punjab.

Wild pigs have a habit of cutting grass and making a kind of shelter in which they are said to leave the young. Old boars may sometimes be found in these lairs, as Simson states in his 'Letters on Sport in Eastern Bengal.'

Pigs are much more prolific than most of the Ungulata. The period of gestation is about 4 months, and they, sometimes at all events, breed twice in the year; the number of young is usually 4 to 6 in *S. scrofa* and probably the same in *S. cristatus*. The European wild pigs breed in the second year and live from 20 to 25 years.

375. **Sus andamanensis.** *The Andaman Pig.*

Sus andamanensis, *Blyth, J. A. S. B.* xxvii, p. 267 (1858); xxviii, p. 271; xxix, p. 103; *id. Cat.* p. 141; *W. Sclater, Cat.* p. 195.

Tail very short. Animal covered with somewhat shaggy and long bristles; no distinct crest on the neck or back in the only skin examined. Molars much less complex than in *S. cristatus*. The hinder molar, above and below, shorter than the two preceding molars together.

Colour. Black, tips of some dorsal bristles brownish grey.

Dimensions. Height at shoulder about 20 inches; basal length of an adult male skull 9, zygomatic breadth 4·5.

Distribution. Forests of the Andaman Islands.

376. **Sus salvanius.** *The pigmy Hog.*

Porcula salvania, *Hodgson, J. A. S. B.* xvi, pp. 423, 593, pls. xii, xiii; xvii, pt. 2, p. 480, pl. xxvii; *Horsfield, P. Z. S.* 1853, p. 192, pl. xxxvii; *Jerdon, Mam.* p. 244; *Sclater, P. Z. S.* 1882, p. 546, pl. xxxvii; 1883, p. 388, pl. xliii, *juv.*; *W. Sclater, Cat.* p. 195.
Sus salvanius, *Garson, P. Z. S.* 1883, p. 413.

Sano banel, Nepal.

No distinct crest, but hair on hind neck and middle of back rather longer. Ears small, naked. Tail very short. No woolly underfur. Three pairs of mammæ. The last molar, either upper or lower, is considerably shorter than the two preceding molars together.

Colour. Brown or blackish brown, black and brown bristly hairs being mixed. The young are dark brown, with longitudinal rufous bands, above and on the sides, white beneath.

Dimensions. An old male measured by Hodgson was 26 inches from snout to rump, 11·25 high at the shoulder, ear 2·75, tail 1·25. Weight 17 lb. The skull measures 5·9 in basal length, and 3·2 in zygomatic breadth.

Distribution. The forest at the base of the Himalayas in Nepal, Sikhim and Bhután.

Habits. Apparently very similar to those of *S. cristatus.* The pigmy hog is chiefly found in high grass-jungle, and is said to live in herds of from 5 to 20, the adult boars keeping with the females. These small pigs are very rarely seen, as, like other swine, they only leave the forest at night.

The *Hippopotamidæ*, now confined to Africa, were, in Pliocene and Pleistocene times, represented in India by several species, some of which probably were contemporaries of man, a worked flint having been found in the Nerbudda gravels that contain bones of *Hippopotamus.* Falconer thought that these animals might have lived until the Arian immigration, and that they might have been the *Jald-hasti*, or water-elephant, of Sanscrit writers, but it appears more probable that the animal thus named was *Platanista.*

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Order CETACEA.

Whales, dolphins, and porpoises constitute an order differing widely, both in form and structure, from all land-mammals. They were at one time supposed to have some affinity with the Carnivora, but Flower has shown that the relationship is doubtful, and that Cetaceans are probably more nearly allied to some of the primitive Ungulates than to any other Mammalia.

The Cetacea are modified for a purely aquatic life and their external form much resembles that of Fishes. There are no external hind limbs, whilst the tail is flattened and expanded into lobes, known as flukes, so as to resemble that of a fish in outline, though the expansion is horizontal instead of vertical. The anterior limbs are converted into paddles, termed flippers or pectoral fins, the digits being completely united together by skin and destitute of nails. There is in most genera a dorsal fin composed of integument. The skin is smooth and hairless, with the exception of a few bristles round the mouth, generally confined to young animals; but the body is surrounded, immediately beneath the skin, by a thick layer of fat or "blubber," which, like the hair or wool of land-animals, serves to retain the heat of the body.

The eye is small and the ear-orifice minute; there is no trace of an external ear. The nostrils open either separately or by a single, generally crescentic, orifice or "blow-hole" much above the extremity of the snout, and in most forms on the top of the head. The mammæ, two in number, discharge each by a teat lying in a groove, one on each side of the genital orifice. The testes are abdominal, the uterus is bicornuate, the placenta non-deciduate and diffuse.

The peculiarities of the skeleton are too numerous for any except the most important to be here mentioned. The bones generally are spongy in texture, the cavities being filled with oil. The skull is greatly modified and consists of a short, almost round brain-case, and of a more or less elongate rostrum. The cervical vertebræ are often partially or wholly anchylosed. There is no sacrum. The mode of attachment of the ribs to the vertebræ is more or less peculiar, and presents modifications characteristic of the different families. There are no clavicles. The radius and ulna are distinct, and are flattened, as are all the bones of the wrist and hand. The digits are 4 or 5 in number, more often the latter, and the phalanges of the second and third digits greatly exceed in number those found in other mammals. A pair of styliform bones represent the pelvis.

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In one large group no teeth occur, except in the fœtus; when teeth are present after birth, all are similar in form, and are not preceded by milk-teeth.

By far the majority of Cetacea are marine, but many enter large rivers, and a few are restricted to them. All are carnivorous and live on fish, crustacea, or mollusca; one genus, *Orca*, preying on seals and whales. Like other mammals, cetaceans are air-breathers and come to the surface of the water to breathe or "blow." The old idea, represented in many pictures, that whales "spout" or eject by the blow-holes water taken in by the mouth, is erroneous, the supposed jet being merely the expired air with watery and mucous particles forming spray. The "spouting" is naturally much more conspicuous in cold regions. The acts of expiration and inspiration are very quickly performed, especially by dolphins.

The order is divided into two suborders thus defined :—

No teeth after birth; baleen present. Breathing-orifice double	MYSTACOCŒTI.
Teeth present throughout life; no baleen. Breathing-orifice single	ODONTOCŒTI.

In the preparation of the following account of Indian cetaceans, I have generally followed Prof. W. H. Flower, to whom I am indebted for much personal aid, in addition to the information published in his papers on various genera of the order.

Suborder *MYSTACOCŒTI.*

Teeth never present after birth. The palate is furnished with numerous plates of baleen or whalebone, serving to strain the water from the fish, crustacea, or mollusca, mostly of small size, on which whales feed. Skull symmetrical. Rami of mandible arched outwards, not uniting in a true symphysis at the distal extremities. Ribs very loosely connected with the vertebræ, and articulating only with their transverse processes; the first rib alone connected with the sternum. External openings of the two nostrils separate, longitudinal. A cæcum present.

Family BALÆNIDÆ.

Characters of the suborder, of which this is the only family. The principal genera are the Right Whales (*Balæna*), with enormous heads, long baleen, no dorsal fin, and united cervical vertebræ, and the Humpbacks (*Megaptera*) and Fin-whales or Rorquals (*Balænoptera*), with smaller heads, shorter baleen, a dorsal fin, and free cervicals. Only the last-named genus has been as yet clearly recorded from Indian seas.

Genus **BALÆNOPTERA**, Lacépède, 1804.

Syn. *Physalus*, *Cuvierius*, *Sibbaldius*, &c., Gray.

Form slender; head flat, pointed, measuring $\frac{1}{4}$ to $\frac{1}{5}$ of the total length. Skin of the throat with deep longitudinal furrows. A small falcate dorsal fin, placed far back about two thirds of the distance from head to tail. Pectoral limbs or flippers small, narrow and pointed, $\frac{1}{7}$ to $\frac{1}{11}$ of total length, tetradactylous. Baleen short and coarse. Cervical vertebræ free.

The members of this genus, known to whalers as Finners, Fin-whales, Fin-backs, Razor-backs, or Rorquals, are found in all seas. Formerly, when Right-whales (*Balæna*) were more common, other whales, and especially Finners and Humpbacks, were not attacked by whalers, as these whales, owing to their greater speed, are more difficult to kill, and they yield far less oil and whalebone. Of late years, however, Finners have been pursued by means of steam-vessels and attacked with improved forms of harpoon-guns, and large numbers have been captured.

Four species of the genus *Balænoptera* have long been known to whalers in the northern seas, but have only recently been clearly identified by naturalists, chiefly through the work of Profs. Flower and Van Beneden. It has been ascertained that all, unlike the Greenland whale (*Balæna mysticetus*), are migratory, and visit the seas of Norway, Iceland, and even of Greenland in summer, returning to warmer seas in winter. It has been satisfactorily shown that some of the Fin-whales of the southern hemisphere (New Zealand, &c.) are identical with those of northern seas; and in his last work ('Hist. Nat. des Cétacés des Mers d'Europe') Prof. Van Beneden has identified all species of *Balænoptera* hitherto described, including those of the Indian seas, with these four species. To facilitate the comparison of Indian whales, the following leading characters of the four are given, chiefly from Mr. R. Collett's descriptions (P. Z. S. 1886, p. 264):—

1. *Balænoptera rostrata.*—Length 25 to 30 feet, seldom exceeding 33 feet. Height of body to total length 1 : 5. Greyish black above, white below, including lower side of tail; a broad band of white across outer side of each flipper, inner side all white. Flippers $\frac{1}{8}$ total length, jaws $\frac{2}{11}$. Vertebræ about 48, ribs 11 pairs.

2. *B. borealis.*—Length 40 to 48 feet, rarely as much as 52. Height to total length 1 : 5½. Bluish black above, with oblong white spots more or less white below; tail and flippers black on both sides. Flippers very small, $\frac{1}{11}$ total length, jaws $\frac{2}{9}$. Vertebræ 55 to 56, ribs 13 pairs.

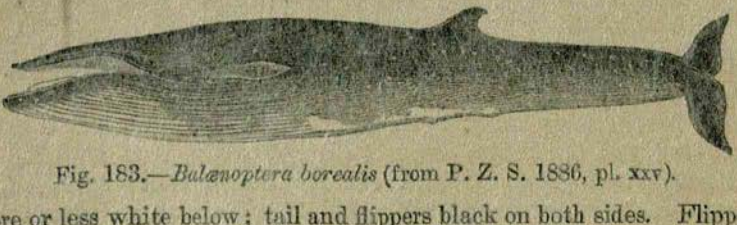

Fig. 183.—*Balænoptera borealis* (from P. Z. S. 1886, pl. xxv).

3. *B. musculus.*—Length 60 to 65 feet, rarely exceeding 70. Very elongate. Height to total length 1 : 6½ or 6¾. Greyish slate above and on left lower jaw; below, with right lower jaw, inside of flippers, and lower side of tail-flukes, white. Flippers 2/9 total length, jaws ⅕. Vertebræ about 62, ribs 15 pairs.

4. *B. sibbaldi.*—Length 70 to 80 feet, rarely exceeding 85. Height to total length 1 : 5½. Dark bluish grey, with small whitish spots on breast; lower edges and inner sides of flippers white. Flippers ⅐ total length, jaws 2/9. Vertebræ about 63, ribs 15–16 pairs.

Curiously enough, four species have been indicated more or less distinctly in the Indian Ocean, viz.: *B. indica* by Blyth, *B. schlegeli*, from Java, by Flower, *B. blythi* and *B. edeni* by Anderson. The first is of the same size as the great *B. sibbaldi*; the second has been clearly identified by its describer with *B. borealis*; *B. blythi* corresponds in size with *B. musculus*; and the published figures representing bones of *B. edeni* are referred by Van Beneden without doubt (*op. cit.* p. 186) to *B. rostrata.* It should, however, be added that Van Beneden, in another part of the same work (p. 155), appears to refer the same *B. edeni* to *B. borealis*, and that there is no evidence as to the locality whence came the few vertebræ to which Anderson (An. Zool. Res. p. 564) gave the name of *B. blythi*; it is uncertain whether these bones are of Indian or even of Asiatic origin. The identifications of *B. indica* and *B. edeni* are probable, but both have been found in Indian seas in the summer, when, according to the theory of migration, they should be in colder regions; and *B. edeni*, although agreeing in most characters with *B. rostrata*, is larger. For the present, therefore, I leave the two undoubted Indian species under the names by which they were described.

The Fin-whales feed on fish and crustacea, and are found sometimes solitary, sometimes in shoals.

Synopsis of Indian Species.

Adults 80 feet or more in length	*B. indica*, p. 567.
Adults about 40 feet long	*B. edeni*, p. 568.

377. **Balænoptera indica.** *The great Indian Fin-whale.*

Balænoptera indica, *Blyth, J. A. S. B.* xxviii, p. 488 (1859) (*conf. op. cit.* xxi, p. 358, xxii, p. 414, xxix, p. 451); *id. Cat.* p. 93; *id. Mam. Birds Burma*, p. 34; *Jerdon, Mam.* p. 161; *Anderson, An. Zool. Res.* p. 551; *Murray, Vert. Zool. Sind*, p. 41, pl. vi (skull); *W. Sclater, Cat.* p. 313.

External characters unknown. Described from two mandibular rami, a rib, the right radius, and 5 vertebræ preserved in the Indian Museum, Calcutta. The character by which the species is especially distinguished, according to Blyth, is the slenderness of the mandible.

Dimensions. Total length of adult 80 to 90 feet. The lower jaw of a specimen said to be 84 feet long measured nearly 21 feet length, 18 inches in vertical diameter at a spot 3 feet in advance of the coronoid process, and nearly 27 inches at the coronoid. The radius was 39 inches long; a rib (probably the third) 8 feet 2 inches.

Distribution. Bay of Bengal and Arabian Sea. A large whale, probably this species, is not rare on the coast of Baluchistan. The animal from which the typical bones were procured was stranded on Amherst Island, Arrakan, in the rainy season of 1851. Another came ashore alive, Sept. 15, 1842, near Chittagong. Other individuals have been stranded on the coast of Sind; of one the skull, 17 feet 8 inches long, is preserved in the Karáchi Museum, and this large whale has also been recorded on the coasts of Malabar and Ceylon.

As already pointed out, this species is probably the same as the great northern Fin-whale (*B. sibbaldi*). It is the largest of all known animals, living or extinct.

378. **Balænoptera edeni.** *The smaller Indian Fin-whale.*

Balænoptera edeni, *Anderson, An. Zool. Res.* p. 551, pl. xliv (skull and vertebræ); *W. Sclater, Cat.* p. 314.

Of this whale, also, no details of the external characters are known, but a skull, the vertebræ, and some other bones of an adolescent individual are preserved in the Indian Museum, Calcutta. The vertebral formula is believed to be C. 7, D. 10, L. 14, C. 21, = 52. The skull is very long, the maxillary portion especially.

Dimensions. Total length of adult probably 40 feet. In an adolescent individual 37 feet long the skull was 9 feet 11 inches long, 4 feet 5 inches broad (a larger skull 10 feet 4 inches by 4 feet 10 inches), lower jaw 9 feet 5 inches; humerus 12·25 inches, radius 22; height of mandible at coronoid process 14, length of baleen about 12. Additional measurements of various bones are given by Anderson.

Distribution. Bay of Bengal. The type was stranded in the Sittoung Estuary, June 18, 1871.

As already pointed out, this whale is referred by Van Beneden to *B. rostrata*.

Although no specimen has yet been procured from the Indian seas, there can be little if any doubt that a species of *Megaptera* exists there. In this genus the head is of moderate size, the body much less slender than in *Balænoptera*, and there is a protuberance or hump forming the base of a low dorsal fin. Throat plicated; baleen-plates short and broad; cervical vertebræ free. The pectoral limb is very long and narrow, being one-fourth the total length of the animal. This whale grows to a length of 50 or 60 feet or even more.

The common Atlantic form, *M. boops*, is said to occur in almost all seas; but another species, *M. indica* (Gervais, Comptes Rendus, xcvii, p. 1566), has been described from the Persian

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Gulf, and Van Beneden is inclined to regard this form as distinct. A skull of *M. boops* from Java is, however, in the Leyden Museum. A whale some years since (July 1873) was entangled in the telegraph-cable off the Baluchistan coast and drowned. The tail was covered with barnacles (Cirripeds), and this, as Van Beneden points out, is characteristic of *Megaptera*. I myself once saw a whale of much stouter form than *Balænoptera*, under favourable circumstances, a great part of the body being above the sea at times, off the mouth of the Indus. Gray (Cat. Seals and Whales B. M. 1866, p. 131) refers an imperfect skeleton in the Asiatic Society's collection at Calcutta to this genus, but on evidence that is scarcely convincing.

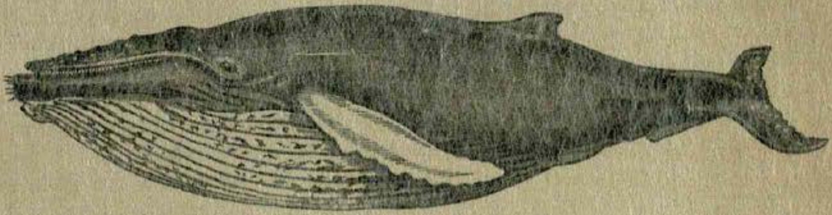

Fig. 184.—Humpbacked Whale, *Megaptera boops*. (Flower, art. "Whale," 'Encyclopædia Britannica.')

The accompanying figure of *M. boops* may assist in the recognition of the genus.

Suborder *ODONTOCŒTI*.

Teeth always present in one or both jaws after birth. No baleen. Upper surface of skull asymmetrical. Rami of mandible nearly straight, meeting distally in a true symphysis. Several of the anterior ribs articulate with the bodies of the vertebræ, and several pairs are connected with the sternum by sternal ribs. Manus always pentadactylous. Nostrils united into a single external orifice. No cæcum, except in *Platanista*.

Three families compose this suborder; all are found in Indian seas or rivers. They are distinguished as follows:—

A. Functional teeth in the lower jaw only	**Physeteridæ.**
B. Functional teeth in both jaws (upper teeth deciduous in *Grampus*).	
a. Ribs abnormally articulated. Symphysis of mandible never exceeding $\frac{1}{3}$ length of ramus	**Delphinidæ.**
b. Ribs normally articulated. Mandibular symphysis $\frac{1}{2}$ length of ramus	**Platanistidæ.**

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Family PHYSETERIDÆ.

No functional teeth in the upper jaw. Teeth in lower jaw varying in number, sometimes only one or two on each side. Bones of cranium rising into a crest behind the nares. Pterygoid bones thick, produced backwards, and not involuted to form the outer wall of the post-palatal air-sinuses. Transverse processes of the arches of the dorsal vertebræ, to which the tubercles of the ribs are attached, ceasing abruptly near the posterior end of the series, and replaced by other processes at a lower level from the bodies of the vertebræ, the latter processes homologous anteriorly with the heads of the ribs, and posteriorly with the transverse processes of the lumbar vertebræ. (In *Physeter* both processes are found in the same vertebra in the region of transition.)

All the members of this family are oceanic, and all, so far as is known, subsist mainly on Cephalopoda (cuttle-fishes). Besides the sperm-whales, which form the subfamily *Physeterinæ*, and have, in each mandibular ramus, several teeth set, not in distinct alveoli, but in a long groove imperfectly divided by partial septa, the present family contains the ziphioid whales, or subfamily *Ziphiinæ*, in which only one or two teeth are functionally developed in each ramus of the mandible. Members of the first subfamily alone are known from the Indian seas, though there can be little if any doubt that some representatives of the *Ziphiinæ*, several of which inhabit the Indian Ocean, occur near the coasts of British India.

Only two genera of sperm-whales are known; both are Indian, and they are easily distinguished thus:—

Head very large; lower teeth 20 to 25 on each side......	PHYSETER.
Head moderate; lower teeth 9 to 13 on each side........	COGIA.

Genus PHYSETER, Linn. (1766).

Syn. *Catodon*, Artedi.

Teeth of the upper jaw rudimentary, simply imbedded in the gum. Lower teeth 20–25 on each side, stout, conical, recurved, pointed until worn, and without enamel. Upper surface of the skull formed of a high semicircular crest, with a deep hollow in front; from the bottom of this hollow the elongate rostrum protrudes. Lower jaw very long, the symphysis half as long as the jaw itself.

Vertebræ: C. 7, D. 11, L. 8, C. 24. Atlas free, the other cervicals united.

Head about one third the length of the body ($\frac{1}{4}$ total length), high, subcylindrical, ending abruptly in front, as if truncated. Blowhole single, longitudinal, and at the left side of the upper anterior extremity of the huge muzzle. The mouth opens beneath the muzzle, and some distance short of the end. Pectoral limbs

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short, broad, and truncated. Dorsal fin replaced by a low protuberance.

The upper part of the huge head is filled with the substance known as spermaceti. The same substance is found, though in smaller quantities, in other *Physeteridæ*, probably in all.

Only one species is known with certainty.

379. **Physeter macrocephalus.** *The Sperm-whale or Cachalot.*

Physeter macrocephalus, *L. Syst. Nat.* i, p. 107 (1766); *W. Sclater, Cat.* p. 314.
Catodon macrocephalus, *Blyth, Cat.* p. 93.

Colour black or blackish throughout, or whitish below.

Dimensions. Males grow to about 60 feet; females are said not to attain more than half that length.

Distribution. Pelagic; found in nearly all tropical and subtropical seas, occasionally visiting colder regions. Formerly this whale is said to have been much hunted in the Bay of Bengal and off Ceylon. The only recorded case of an individual being stranded on the Indian coast, so far as I am aware, took place in January 1890 at Madras, and was noticed by Mr. Thurston, Superintendent, Government Central Museum. The animal was about 24 feet long.

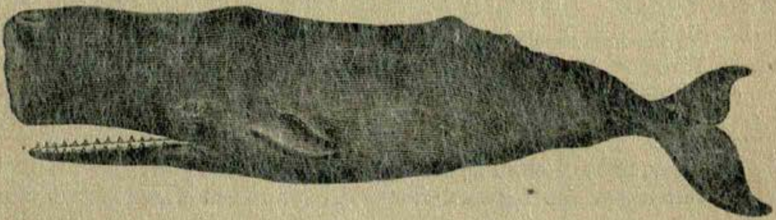

Fig. 185.—Sperm-whale (*Physeter macrocephalus*). (Flower, Art. "Whale," 'Encyclopædia Britannica.')

Habits. The Sperm-whale is found in the open sea, generally in herds or "schools" varying from ten or fifteen to a very large number, sometimes, it is said, as many as two hundred animals. The old males live apart. All wander much, sperm-whales having been killed in the Atlantic with harpoons that had been left in them in the Pacific Ocean. These animals can dive for a long time and to great depths. Their movements are more rapid than those of other whales.

The Cachalot, like other *Physeteridæ*, appears to feed entirely on Cephalopoda (cuttle-fishes). Besides the spermaceti from the head and sperm-oil from the blubber, this whale yields ambergris, which is a concretion formed in the intestine and found sometimes floating on the sea.

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Genus **COGIA**, Gray, 1846.

Syn. *Kogia*, auct.; *Euphysetes*, MacLeay (1851).

Upper teeth absent, or represented by a rudimentary anterior pair embedded in the gum; 9 to 13 lower teeth on each side, long, slender, pointed, curved backwards, and coated with enamel. Upper surface of cranium slightly concave, rostrum not longer than cranial portion of skull. Mandibular symphysis less than half the entire length of the rami.

Vertebræ: C. 7, D. 13–14, L. & C. 30. All cervical vertebræ united.

External form not unlike that of a porpoise. Head about one sixth of the total length, obtusely pointed in front. Mouth small, inferior, and considerably short of the end of the snout. Blowhole crescentic, on top of head, but to the left of the median line and anterior to the eyes. Pectoral fins obtusely falcate. A well-developed dorsal fin.

Several nominal species have been described, but all are probably varieties of one.

380. **Cogia breviceps**. *The small Sperm-whale.*

Physeter breviceps, *Blainv. Ann. Anat. Phys.* ii, p. 337 (1838).
Kogia breviceps, *Gray, Zool. Erebus & Terror*, p. 22 (1846).
Euphysetes grayii, *Wall, Hist. New Sperm Whale, Sydney*, p. 37 (1851).
Euphysetes macleayi, *Krefft, P. Z. S.* 1865, p. 708, figs.
Physeter (Euphysetes) simus, *Owen, Tr. Z. S.* vi, p. 30, pls. x–xiv (1866); *Elliot, ib.* p. 171.

Wongu, Telugu.

Colour. Above shining black, growing paler below.

Dimensions. An immature female, captured at Vizagapatam, was 7 ft. 2 in. long, from muzzle to dorsal fin 3 ft. 4 in., snout to pectoral limb 17 inches, length of pectoral 14, breadth of tail-flukes 22. The dorsal fin was 11 inches high and 1 foot long, the girth in front of the dorsal 4 ft. 4 in. (Elliot, Tr. Z. S. vi, p. 172). The

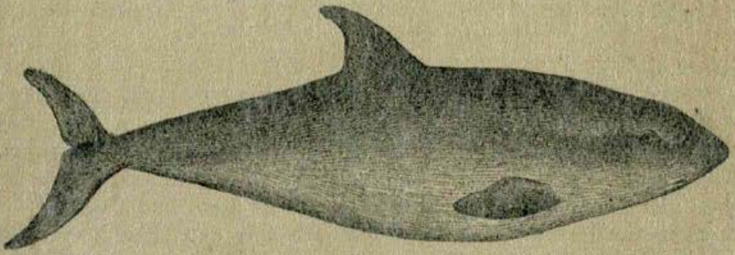

Fig. 186.—*Cogia breviceps*. (From Elliot's figure.)

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dimensions given by Owen were incorrect. Australian individuals have been measured exceeding 10 feet in length.

Distribution. Indian and Australian seas; Cape of Good Hope; North Pacific. Probably widely distributed. Habits quite unknown. The specimen obtained at Vizagapatam by Sir W. Elliot was the type of *P. simus*, Owen.

It has already been pointed out, that some members of the *Ziphiinæ* are in all probability found in the Indian seas. They are small whales, generally from 10 to 25 feet long, the best known being the "Bottle-nose" (*Hyperoodon rostratus*) of the North Atlantic. Amongst the forms probably inhabiting the seas around India are *Ziphius cavirostris*, with a single tooth near the anterior end of each mandibular ramus; and *Mesoplodon densirostris* (*Dioplodon sechellensis*, Gray), with a large tooth on each side in the middle of the lower jaw.

Family DELPHINIDÆ.

The present family comprises all porpoises and true dolphins *, with the exception of a few fluviatile types. The species are much more numerous than those of any other family of Cetacea.

The size in general is moderate or small. The teeth (except in the genus *Grampus*) are numerous in both jaws. The pterygoid bones are short, thin, each involuted to form, with a process of the palate-bone, the outer wall of the post-palatine air-sinus. Symphysis never much exceeding one third of the mandible in length and generally much shorter. Transverse processes of the dorsal vertebræ gradually transferred from the arches to the bodies of the vertebræ without any sudden break; each anterior rib attached to the transverse process by the tubercle and to the body of the vertebra by the head, the latter attachment lost in the posterior ribs. Sternal ribs firmly ossified. Cervical vertebræ varying, the first two to four generally united.

The genera of this family tend to pass into each other, and with a few exceptions are very difficult to distinguish. Professor Flower (P. Z. S. 1883, p. 466) has, however, reduced the numerous genera of Gray into order; and recently, in 1889, Mr. F. W. True has published a review of the family *Delphinidæ* (Bulletin no. 36 of the United States National Museum, Washington), and has done much towards distinguishing the various species and eliminating unnecessary synonyms. The following descriptions are in great measure taken from the two works just quoted.

Our knowledge of the Indian porpoises and dolphins is still extremely imperfect. For the little we know, we are chiefly indebted to Blyth *, Elliot, and Anderson. In all probability several species have still to be recognized, whilst of some of those known only single occurrences have hitherto been recorded. Skins are difficult to preserve, and of no great use in identification; a good sketch to scale and a skeleton are better.

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* The Dolphin of sailors, celebrated for the changes of colour it undergoes when dying, is a fish (*Coryphæna hippurus*).

Synopsis of Indian Genera.

A. Teeth small, spade-like, with flat crowns	PHOCÆNA.
B. Teeth very large, an inch in diameter or more.	ORCA.
C. Teeth moderate or small, conical.	
a. Head globose, no trace of a beak.	
a'. Teeth confined to anterior half of rostrum.	GLOBICEPHALUS.
b'. Teeth occupying greater part of rostrum..	ORCELLA.
b. Head with a short, not very distinct beak ..	LAGENORHYNCHUS.
c. Head with a distinct compressed beak.	
a'. Teeth not less than ⅕ inch in diameter, and round in section.	
a''. Symphysis much shorter than ¼ mandible	TURSIOPS.
b''. Symphysis longer than ¼ mandible....	STENO.
b'. Teeth less than ⅕ inch in diameter, oval in section, and exceeding 35 on each side of each jaw	DELPHINUS.

Genus **PHOCÆNA**, Cuvier (1817).

Syn. *Neomeris*, Gray (1846) (*nec* Lamouroux).

Size small. Head without a beak, snout rounded. Dorsal fin variable, wanting in the only Indian species.

Teeth 16 to 26 on each side of each jaw, small, spade-shaped, the crown being much broader than the root, and compressed in the direction of the jaw, the upper border either entire or divided into two or three lobes. Rostrum short and broad, palate very broad. Pterygoid bones small, widely separated. Mandibular symphysis short. Vertebræ 57 to 67.

This genus, the type of which is the common porpoise of the British Islands, is widely distributed on sea-coasts and in estuaries. One species is found in India.

381. **Phocæna phocænoides.** *The little Indian Porpoise.*

Delphinapterus phocænoides, *Cuv. Règne An.* éd. 2, i, p. 291 (1829).
Neomeris phocænoides, *Gray, Zool. Ereb. & Terror*, p. 30 (1846); *Blyth, J. A. S. B.* xxix, p. 449; *id. Cat.* p. 89; *Flower, P. Z. S.* 1883, p. 506; *True, Delphinidæ*, pp. 114, 178, pl. xxxiv, figs. 1, 2; *W. Sclater, Cat.* p. 318.

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* I am indebted to Mr. W. L. Sclater, who has kindly made notes and measurements of the specimens preserved in the Calcutta Museum, for much assistance in identifying the species mentioned by Blyth.

Delphinus melas, *Temm. Faun. Jap., Mam. Mar.* p. 14, pls. xxv, xxvi, 1847 (*nec Traill*, 1809).
Delphinapterus molagan, *Owen, Tr. Z. S.* vi, p. 24 (1866).
Neomeris kurrachiensis, *Murray, A. M. N. H.* (5) xiii, p. 351 (1884); *id. Jour. Bombay N. H. Soc.* i, p. 159, plate.

Molagan, Tamul (Elliot); *Bhulga*, Mahr. (Sinclair).

Snout rounded; head very convex. No dorsal fin; pectorals subovate. A band of tubercles on the back, broad in front, narrow behind, from above the insertion of the pectorals to above the vent. Teeth about $\frac{18}{18}$ (18 on each side of each jaw). Vertebræ; C. 7, D. 12–13, L. & C. 38–43.

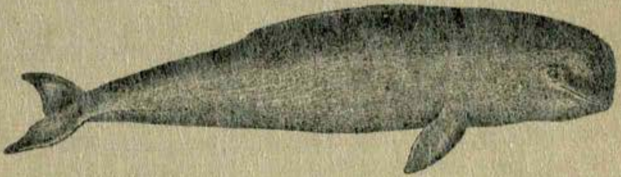

Fig. 187.—*Phocæna phocænoides.* (From a drawing by R. A. Sterndale.)

Colour. Black throughout; a purplish-red patch on the upper lip and one on the throat were observed by Murray.

Dimensions. Length 45 inches, snout to pectoral fin 10, expanse of tail 9 (*Murray*). A Bombay female was 50 inches long, 31 in girth, with a tail 15 wide and pectoral fin 9 long; weight 60 lbs. Basal length of skull 7·75, length of rostrum 3, breadth of skull between orbits 4·75.

Distribution. The shores of the Indian Ocean, from the Cape of Good Hope to Japan. Recorded in India from tidal rivers near Calcutta; also from Madras, Malabar, Bombay, and Karáchi.

Habits. For the following details I am indebted to Professor Flower, to whom they were sent by Mr. W. F. Sinclair of Bombay. This porpoise "frequents the tidal creeks, not ascending very far, and the sounds among the reefs and islands. It feeds chiefly on prawns, also on small cephalopods and fish. It does not appear to herd in 'schools'; more than four or five are rarely, if ever, seen together. Usually it is solitary; the pairs seem to consist of female and calf, more often than male and female. The young (one in number) are born, apparently, about October. The roll of this porpoise is like that of *Phocæna communis.* It does not jump or turn summersaults like *Platanista* and the *Delphini*, and is, on the whole, a sluggish little porpoise."

According to Mr. Sinclair's observations, this species is only found in shallow water.

This porpoise has generally been placed in the genus *Neomeris*, distinguished from *Phocæna* by wanting a dorsal fin. As there is no other distinction, and the species are in other respects nearly allied, it appears unnecessary to maintain the generic distinction.

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Genus **ORCA**, Wagler (1830).

Size very large. No beak; head conical and depressed. Dorsal fin erect, very high, especially in the male. Pectoral fins large, broadly ovate.

Teeth few, 10 to 13 on each side above and below, very large, often an inch or more in diameter, oval in section, the longer diameter across the jaw. Rostrum broad. Pterygoids separate. Vertebræ: C. 7, D. 11–12, L. 9–10, C. 24=51 or 52.

The animals of this genus are highly predatory, living on seals, whales, and other cetaceans, besides fish. They associate in small herds, and are said to attack and kill even the largest whales. Many species have been described, but it is quite uncertain how far they can be distinguished.

382. **Orca**, sp. (O. gladiator ?—*The Grampus or Killer*).

? Delphinus orca, *L. Syst. Nat.* i, p. 108 (1766).
? Delphinus gladiator, *Bonnaterre, Cét.* p. 22 (1789).
? Orca gladiator, *Gray, Zool. Ereb. & Terror*, p. 33; *Flower, P. Z. S.* 1883, p. 507; *True, Delphinidæ*, p. 187, pl. xlv, figs. 1, 2.
Cetacean, *Holdsworth, P. Z. S.* 1872, p. 583 (figs. p. 584).

A cetacean was seen by Mr. E. W. H. Holdsworth in April 1868 off the west coast of Ceylon, and briefly described by him, the description being illustrated by sketches. The animal appeared to be about 25 feet long, and was furnished with a remarkable straight, erect, narrow dorsal fin about 5 feet high. As figured the fin appears scarcely a foot broad, with the anterior and posterior margins nearly parallel.

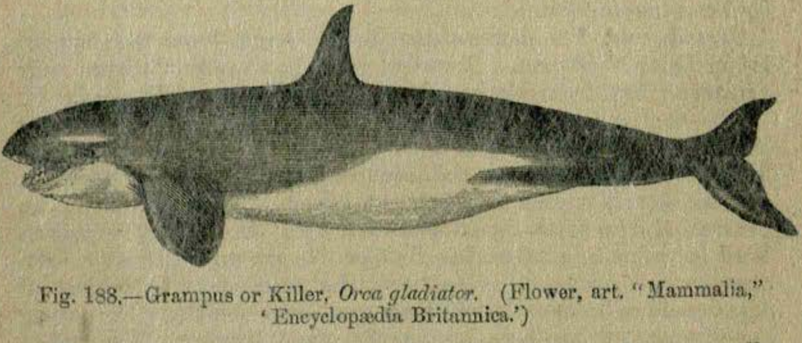

Fig. 188.—Grampus or Killer, *Orca gladiator*. (Flower, art. "Mammalia," 'Encyclopædia Britannica.')

The only cetacean with a fin of this kind is *Orca*, but generally the dorsal fin, though very high, especially in the male, is represented as triangular. There is a skull of *O. gladiator* from the Seychelle Islands in the British Museum, so this species is an inhabitant of the Indian Ocean. *O. gladiator* grows to about 20 feet in length, the teeth are 10–13 in number on each side above and below, and the coloration is peculiar—the upper parts generally, with the fins, black; the lower to the vent white, but the white

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forms a trident posteriorly and there are white patches on each side of the head. The accompanying figure may enable the species, if seen in Indian seas, to be recognized.

Genus **GLOBICEPHALUS**, Lesson (1842).

Head globular, no beak. Dorsal fin long, low and thick. Pectoral fins narrow and long.

Teeth few and confined to the anterior half of the rostrum and to the corresponding part of the mandible. Skull broad and depressed, rostrum broad and flat; premaxillæ very broad, nearly or quite covering the maxillæ anteriorly. Symphysis of mandible short. Pterygoids large, prominently keeled and in contact. Vertebræ: C. 7, D. 11, L. 12–14, C. 26–29 = 56–59.

The members of this genus, known as 'Ca'ing Whales,' 'Pilot Whales,' and 'Blackfish,' are found in all seas and grow to a considerable size.

383. **Globicephalus indicus.** *The Indian Pilot Whale.*

Globicephalus indicus, *Blyth, J. A. S. B.* xxi, p. 358, xxviii, p. 490; *id. Cat.* p. 89; *Jerdon, Mam.* p. 160; *True, Delphinidæ*, p. 137; *W. Sclater, Cat.* p. 319.

Nearly allied to *G. melas* of the European seas, but the colour is different, there are fewer and stouter teeth, 6–7 above and 7–8 below on each side, and the premaxillaries are much broader and completely cover the maxillaries in the rostrum. Vertebræ: C. 7, D. 11, L. 12, C. 26 = 56.

Colour uniform leaden black, slightly paler beneath.

Dimensions of an adult male:—Length 14 ft. 2 in., pectoral fin 24 inches long and 6 broad, dorsal fin 27 long and 11 high, expanse of tail 3 ft. Total length of a skull 65 inches, length of rostrum 33, breadth of skull between orbits 47, breadth of beak at the middle of its length 25, breadth of premaxillæ at same place 22.

Distribution. This large porpoise has hitherto only been observed on one occasion in the salt or brackish water of the Gangetic delta.

Habits. The typical examples, two in number, were from a shoal that were found stranded by Blyth on the shallows of Salt-water Lake, near Calcutta, in July 1852. The shoal was said to have consisted originally of several dozens. The animals when observed were floundering about in the shallow water and groaning painfully. Other specimens, which Mr. Blyth regarded as the young of this cetacean, have been shown by Dr. J. Anderson (An. Zool. Res. p. 369) to be *Orcella brevirostris*.

A genus somewhat allied to *Globicephalus*, and resembling it in external form, is *Grampus*, a pelagic type, of which a representative is very likely to be found in Indian seas. There are no teeth in

GSL

the upper jaw in adults, and 2 to 7 on each side of the lower jaw near the symphysis. The common species, *G. griseus*, which has a very wide range, is about 10 feet long, and grey in colour, the back and fins black and belly white; the sides with numerous irregular pale streaks.

Genus **ORCELLA**, Gray (1866).

Head globose, no beak. Dorsal fin small, falcate. Pectoral fins of moderate size, broad at the base, subovate.

Teeth 13 to 17 on each side of the upper jaw, 12–15 in the lower; small, conical, pointed, closely set, occupying nearly the whole length of the rostrum, the posterior teeth disappearing with age. Generally (perhaps in all adults) the anterior teeth in both jaws are directed outwards, becoming at the anterior extremity of each jaw almost horizontal. Rostrum short, tapering, broad at the base; premaxillaries broad. Pterygoids widely separated from each other, and very bluntly keeled. Mandibular symphysis short. Vertebræ: C. 7, D. 12–13, L. 14–15, C. 29–30 = 62–63.

Two species have been described, one marine, the other fluviatile, both Indian or Burmese. A full account of the anatomy of both is given by Anderson in his 'Anatomical and Zoological Researches.'

Synopsis of Indian and Burmese Species.

Colour blackish, without streaks..........	*O. brevirostris*, p. 578.
Colour pale slaty, with streaks............	*O. fluminalis*, p. 579.

384. **Orcella brevirostris.** *The larger Indian Porpoise.*

Phocæna (Orca) brevirostris, *Owen, Tr. Z. S.* vi, p. 24, pl. ix, figs. 1, 2, 3 (1866).

Orcella brevirostris, *Anderson, P. Z. S.* 1871, p. 143, fig. 1; *id. An. Zool. Res.* p. 369, pl. xxv, figs. 4, 5, pl. xliii, figs. 6–10; *True, Delphinidæ*, p. 182, pl. xxxviii, figs. 1, 2; *W. Sclater, Cat.* p. 318.

Lomba-lomba, Malay.

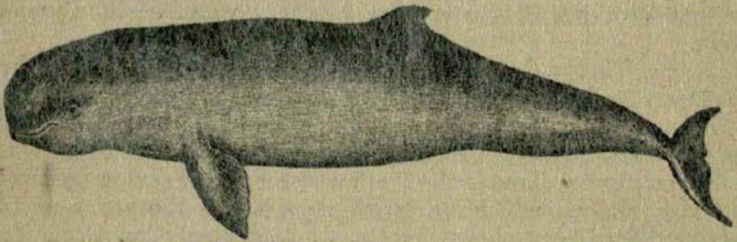

Fig. 189.—*Orcella brevirostris.* (From Anderson's figure.)

Anterior profile of head very convex. Dorsal fin commencing about middle of length, small, falcate, obtusely pointed. Pectoral fins subtriangular, pointed. Teeth about $\frac{16}{13}$.

GSL

Colour. Dark slaty blue, nearly black, above, and but little paler below.

Dimensions. Total length about 7 feet. Snout to dorsal fin 46 inches, height of dorsal 3·75, snout to pectoral 16·5, anterior margin of pectoral 17, breadth of pectoral 6·20, expanse of caudal fin 21·5. A skull measures 10·6 in basal length, 7·4 broad across orbits, length of rostrum 5·1.

Distribution. Bay of Bengal, ascending rivers as far as the tide extends; also found at Singapore and in North Borneo.

385. **Orcella fluminalis.** *The Irrawaddy Porpoise.*

Orcella fluminalis, *Anderson, P. Z. S.* 1871, p. 143, fig. 2; *id. An. Zool. Res.* p. 358, pls. xxv *a*, xxvii, &c.; *Blyth, Mam. Birds Burma*, p. 34; *True, Delphinidæ*, p. 182; *W. Sclater, Cat.* p. 319.

Form very similar to that of *O. brevirostris*. The dorsal fin is situated somewhat farther back, and is smaller, lower, and less falcate, and the pectorals are rather shorter and broader. The head is less globose. Teeth about $\frac{15}{14}$.

Colour. Pale slaty above, whitish below, numerous narrow streaks irregularly dispersed on the sides.

Dimensions. Length of a male 7½ feet, snout to dorsal fin 55 inches, to pectoral 17, length of pectoral along anterior margin 17. Basal length of a skull 10·3 inches, breadth between orbits 7, length of rostrum 4·6. In another male 86 inches long, the dorsal fin was a little over 2 high.

Distribution. The deeper channels of the Irrawaddy from below Prome to above Bhámo. This porpoise has not been observed in the tidal waters of the river delta.

Habits. The Irrawaddy porpoise is gregarious, solitary individuals being rare, and it keeps to deep water, rising to breathe every minute or two as a rule, and emitting "the short blowing sound, which ends in the more feeble one of inspiration" (*Anderson*). The food, so far as known, is exclusively fish.

Mr. Thomas has recently united this species with *O. brevirostris*, but the absence of that form in other Indian rivers renders it probable that *O. fluminalis* is really distinct.

Genus **LAGENORHYNCHUS**, Gray (1846).

Head with a short, not very distinct beak, or pointed, without a beak. Dorsal and pectoral fins moderate. Caudal ridges very prominent.

Teeth variable in size. Rostrum flat, not greatly exceeding the remainder of the skull in length. Premaxillæ flat or slightly convex above. Pterygoids usually in contact. Mandibular symphysis short. Vertebræ very numerous, 73 to 92 (generally over 80).

GSL

Several species are known; of these two have been obtained in India.

Synopsis of Indian Species.

Teeth about $\frac{22}{23}$; breadth of skull more than half its length	*L. electra*, p. 580.
Teeth about $\frac{30}{30}$; breadth of skull less than half its length	*L. obscurum*, p. 580.

386. **Lagenorhynchus electra.** *The Indian broad-beaked Dolphin.*

Lagenorhynchus electra, *Gray, Zool. Ereb. & Terror*, p. 35, pl. xiii (1846); *Flower, P. Z. S.* 1883, p. 490; *True, Delphinidæ*, pp. 100, 173, pl. xxviii, figs. 1, 2; *W. Sclater, Cat.* p. 321.
Delphinus (Lagenorhynchus) fusiformis, *Owen, Tr. Z. S.* vi, p. 22, pl. v, fig. 1, pl. vii.

A short and broad beak. Dorsal and pectoral fins falcate. Snout broad. Teeth about $\frac{22}{23}$, conical, curved inwards, about $\frac{1}{5}$ inch in diameter, confined to the anterior two thirds of the rostrum and less than half the mandible. Rami of mandible deep in the posterior half and slender in front.

Colour. Dark above, darkest on the dorsal fin, the fore part of the pectoral and caudal fin, and the snout; ashy grey unspotted below (*Owen*). But a specimen of the same species from the Pacific is described as blue-black, with a white spot in front of each pectoral fin, a frontal band of light slate-colour, vent and abdomen reddish white.

Dimensions. An adult female measured 6 feet long, snout to pectoral fin 19½ inches, to dorsal 31, length of pectoral fin along front margin 12, of dorsal 10. Basal length of skull 17, breadth across orbits 9·5, length of rostrum 9·75, breadth of same at base 5·4.

Distribution. Indian and Tropical Pacific Oceans. Obtained at Vizagapatam by Sir W. Elliot.

387. **Lagenorhynchus obscurum.** *The beakless Dolphin.*

Delphinus obscurus, *Gray, Spic. Zool.* p. 2 (1828); *id. Zool. Ereb. & Terror*, p. 37, pl. xvi; *Blyth, Cat.* p. 90.
Lagenorhynchus obscurus, *True, Delphinidæ*, pp. 104, 174, pl. xxix, figs. 1, 2.
Prodelphinus obscurus, *Flower, List Cetacea B. M.* p. 28 (1885); *W. Sclater, Cat.* p. 324.

No distinct beak, the head sloping gradually down to the upper lip. Fins falcate. Teeth about $\frac{30}{30}$, small, less than $\frac{1}{6}$ inch in diameter, curved inwards, those in the upper jaw occupying about $\frac{7}{8}$ of the rostrum. Skull and rostrum much narrower than in *L. electra*, and intermediate in form between those of that species and those of *Delphinus*.

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Colour. Black, neck and belly white, a black band from the angle of the mouth to the pectoral fins; lateral oblique streaks of white (*Gray*).

Dimensions. Length (of type skin) 65 inches, length of pectoral fin 11; of a skull 14, breadth across orbits 6·7, length of rostrum 8, breadth of same at base 3·75.

Distribution. Indian and Pacific Oceans. A skull from Palk Straits, Ceylon, is in the Museum, Calcutta.

Genus **TURSIOPS**, Gervais (1855).

General form stout. Beak moderate, tapering, separated by a groove from the forehead; dorsal and pectoral fins falcate.

Skull and rostrum much broader than those of *Steno* or *Delphinus*. Rostrum moderately long, very convex above, tapering. Pterygoids in contact. Mandibular symphysis short. Teeth stout (about $\frac{1}{4}$ inch in diameter), occupying nearly the whole jaw. Vertebræ in *T. tursio*: C. 7, D. 13, L. 17, C. 27 = 64.

It is probable that two species of *Tursiops* occur around India, but only one has hitherto been recognized.

388. **Tursiops tursio.** *The common bottle-nose Porpoise.*

Delphinus tursio, *Fabricius, Fauna Grœnland.* p. 49 (1780); *Flower, Tr. Z. S.* xi, p. 3, pl. i.
Delphinus eurynome, *Gray, Zool. Erebus & Terror,* p. 38, pl. xvii (1846); *Blyth, Cat.* p. 90.
Tursiops tursio, *Flower, P. Z. S.* 1883, p. 478; *True, Delphinidæ,* pp. 32, 158, pl. viii, figs. 1, 2; *W. Sclater, Cat.* p. 323.

Teeth about $\frac{22}{22}$. Rostrum broad, depressed, forming more than half the length of the skull, its breadth in the middle $\frac{1}{3}$ to $\frac{1}{4}$ its length.

Colour of Eastern animals not known. Atlantic specimens are clear plumbeous grey, more or less tinged with purple, above, including the dorsal, pectoral, and caudal fins, and passing gradually into pure white on the belly. The limits of the two colours vary. Some individuals are black above, pale grey below, some all grey.

Dimensions. Total length of an adult male 9 ft. 6 in., snout to dorsal fin 50 inches, length of pectoral fin 15·5, vertical height of dorsal 9, breadth of flukes 24. Some individuals exceed 10 ft. in length. Skull 22 inches long, 11 broad between orbits, rostrum 12·5 long.

Distribution. Probably throughout temperate and tropical seas. Blyth records a skull of an animal captured in the Bay of Bengal. In the British Museum are specimens from Muscat and the Seychelle Islands.

It is highly probable that either *Tursiops catalania* described from N.W. Australia, or the closely allied *T. abusalam*, inhabiting the Red Sea, is also found in the neighbourhood of India. The

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two may be identical. Both are smaller than *T. tursio* and have dark spots on the lower surface. The skull of *T. catalania* is 16·75 inches long by 7·5 broad between the orbits, rostrum 9·75 long. *Delphinus* (*Steno*?) *maculiventer* (p. 585) of Owen may be *Tursiops catalania*.

Genus **STENO**, Gray (1846).

Head prolonged into a distinct narrow snout, which is separated by a groove from the forehead. Dorsal and pectoral fins falcate.

Rostrum of skull long, narrow and compressed. Symphysis of mandible long, one fourth to one third the length of the ramus. Teeth of moderate size, about one fifth (4–6 millim.) of an inch in diameter; 20 to 35 on each side of each jaw. Vertebræ of *S. frontatus*: C. 7, D. 12, L. 15, C. 32=66.

The species found on the coast of India are in part referred to *Sotalia* by Flower and True; but the differences between the Indian types here brought together appear to me scarcely to justify generic distinction, until the skeletons are known. The typical *Sotaliæ* are estuarine or fluviatile dolphins with 51 to 55 vertebræ.

Synopsis of Indian Species.

A. Teeth very rugose, $\frac{20}{20}$ to $\frac{25}{27}$ .... *S. frontatus*, p. 582.
B. Teeth nearly smooth.
  a. Rostrum more than $\frac{2}{3}$ length of skull; teeth about $\frac{37}{34}$ .... *S. plumbeus*, p. 583.
  b. Rostrum less than $\frac{2}{3}$ of skull.
    a'. Dark grey above; teeth about $\frac{26}{26}$.... *S. perniger*, p. 583.
    b'. Speckled throughout; teeth about $\frac{34}{35}$ *S. lentiginosus*, p. 584.
    c'. Black above; teeth $\frac{27}{30}$ .... *S.*? *maculiventer*, p. 585.

389. **Steno frontatus.** *The rough-toothed Dolphin.*

Delphinus rostratus, *Shaw, apud Cuv. Ann. Mus.* xix, p. 10 (1812); *Desmarest, Nouv. Dict. H. N.* ix, p. 160, *nec Shaw*.
Delphinus frontatus, *Cuv. Oss. Foss.* éd. 2, v, pp. 278, 400, partim (1823).
Delphinorhynchus rostratus, *Blyth, J. A. S. B.* xv, p. 368.
Steno rostratus, *Blyth, J. A. S. B.* xxviii, p. 491; *Flower, P. Z. S.* 1883, p. 483; *True, Delphinidæ*, pp. 24, 157, pl. vi, figs. 1, 2; *W. Sclater, Cat.* p. 324.
Steno frontatus, *Blyth, Cat.* p. 91.

Snout long. Teeth $\frac{20}{20}$ to $\frac{25}{27}$, distinctly rugose, the enamel closely pitted with irregular very wavy furrows. Rostrum long and compressed, its breadth in the middle varying from $\frac{1}{8}$ to more than

$\frac{1}{6}$ of its length. Pterygoids in contact along the median line. Mandible with its inferior border very convex at the symphysis, which is very long, fully $\frac{1}{3}$ the ramus.

Colour. In an Atlantic specimen the upper parts and fins were purplish sooty black; sides marked with rather large stellate white spots. Snout and under surface of body white, more or less tinged with purple and rose-colour and marked with prominent purple spots (*Lütken*). The colour of Eastern specimens has not been recorded, and there may be much variation.

Dimensions. Total length 8 ft. 6 in.; snout to dorsal fin 44 inches, to pectoral 25. Length of a large skull 19·5, of rostrum 11·5; breadth of skull between orbits 7, greatest breadth 8·5.

Distribution. Indian and Atlantic Oceans. Found in the Bay of Bengal; a specimen having been captured near the Nicobar Islands.

390. **Steno plumbeus.** *The plumbeous Dolphin.*

Delphinus plumbeus, *Dussumier, Cuv. Règne An.* éd. 2, i, p. 283 (1829); *Pucheran, Rev. Mag. Zool.* (2) viii, 1856, pp. 146, 315, 362, 449; *Jerdon, Mam.* p. 157.

Sotalia plumbea, *Flower, P. Z. S.* 1883, pp. 489, 513; *True, Delphinidæ*, pp. 21, 153, pl. i, figs. 1, 2; *W. Sclater, Cat.* p. 325.

La-maing, Burmese.

Snout very long; dorsal fin long and but little elevated; pectoral limbs short, about $\frac{1}{7}$ total length; caudal ridges prominent.

Teeth about $\frac{37}{34}$ (37 on each side of upper jaw, 34 on each side of lower). Rostrum more than $\frac{3}{5}$ length of skull; its breadth at the middle $\frac{1}{6}$ its length. Pterygoids not in contact. Symphysis of mandible one third length of jaw.

Colour. Uniform plumbeous grey, except on the extremity and underside of the lower jaw, where it is white.

Dimensions. Total length 7 ft. 9 in.; tip of snout to dorsal fin 34 in., to pectoral 23; length of anterior margin of dorsal fin 17, of pectoral 14; expanse of tail-flukes 22. Skull 22 inches long, beak 13·75, breadth of skull between orbits 7·5.

Distribution. Indian Ocean. Recorded from Madras, Ceylon, the Malabar coast, and Karáchi, and said to be common in tidal estuaries in Burma.

391. **Steno perniger.** *Elliot's Dolphin.*

Delphinus perniger, *Elliot, Blyth, J. A. S. B.* xvii, pt. 1, p. 250; *Blyth, Cat.* p. 91; *Jerdon, Mam.* p. 157.

Delphinus (Steno) gadamu, *Owen, Tr. Z. S.* vi, p. 17, pls. iii, iv (1866).

Sotalia gadamu, *Flower, P. Z. S.* 1883, pp. 489, 513; *True, Delphinidæ* pp. 13, 154, pl. ii, figs. 1, 2; *W. Sclater, Cat.* p. 325.

Tursiops perniger, *W. Sclater, Cat.* p. 323.

Gadamu, Telugu.

Snout long and compressed; pectoral and dorsal fins falcate and of similar size, the pectorals long, nearly $\frac{1}{5}$ of the total length; caudal ridges prominent.

Teeth about $\frac{26}{26}$ (varying from 23 to 28). Rostrum less than $\frac{3}{5}$ length of skull; its breadth at the middle about $\frac{1}{5}$ its length. Pterygoids close together on median line, but not in contact. Symphysis less than $\frac{1}{3}$ length of mandible.

Colour. Upper parts dark plumbeous grey, almost black upon the fins, becoming paler on the sides and passing into pinky ashy grey, with a few small irregular darker blotches, on the breast and abdomen.

Dimensions. Total length of an adult female 6 ft. 10 in.*; tip of snout to dorsal fin 36 inches; length of base of dorsal 13, length of anterior margin of dorsal 16, of pectoral 18; expanse of tail-flukes 22 (*Owen*). Skull 17 inches long, rostrum 10, breadth of skull between orbits 6·75.

Distribution. Indian Ocean. Recorded from Vizagapatam and Karáchi in India, and from Australia.

Mr. W. L. Sclater has sent to me the rostrum of *D. perniger* from the type skin preserved in the Museum, Calcutta (the rest of the skull is not preserved). I have compared this rostrum with that of the typical skull of *S. gadamu* in the British Museum, and find the two identical.

392. Steno lentiginosus. *The speckled Dolphin.*

Delphinus (Steno) lentiginosus, *Owen, Tr. Z. S.* vi, p. 20, pl. v, figs. 2, 3.
Sotalia lentiginosa, *Flower, P. Z. S.* 1883, pp. 489, 513; *True, Delphinidæ*, pp. 15, 155, pl. ii, fig. 3; *W. Sclater, Cat.* p. 325.
Delphinus lentiginosus, *Sterndale, Jour. Bombay N. H. Soc.* ii, p. 51.

Bolla gadimi, Tel.

General form similar to that of *S. perniger*, but with smaller and less falcate pectoral and dorsal fins and the tail-flukes wider from front to back. The dorsal fin is longer at its base, being about $\frac{2}{9}$ of the total length. Length of pectoral about $\frac{1}{8}$ of total. Caudal ridges prominent.

Teeth about $\frac{34}{35}$. Breadth of rostrum at the middle $\frac{1}{6}$ its length.

Colour. "Pretty uniformly bluish cinereous or slaty, freckled with irregular small spots of brown or plumbeous pigment, the streaks longitudinal and flecked with white (*Owen*, probably from the drawing). Sinclair, quoted by Sterndale, describes the colour as "Above (and below behind the anus) rather pale leaden grey, with numerous long drop-shaped spots. Of these the majority, especially on the rostrum, limbs, dorsal fin, and flukes, are pure white, the rest dark slate-colour or black. Below, from the anus forward, the general ground-colour is white, much mottled on the belly with the dorsal ground-colour, less so on the breast, and the mental (chin) region almost pure white; but there are a few black spots." There is probably some variation.

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* Unfortunately it is not stated whether the measurements were made on the animals by Sir W. Elliot, or merely calculated from the drawings by Sir R. Owen. The same remark applies to the dimensions of *S. lentiginosus* and *S. maculiventer*. I have been unable to trace the original drawings.

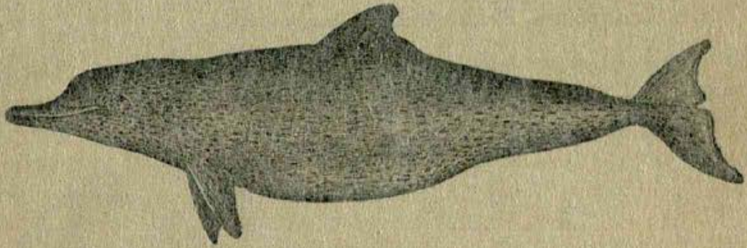

Fig. 190.—*Steno lentiginosus.* (From Elliot's figure.)

Dimensions. Total length of an adult female (Vizagapatam) 7 ft. 10 in.; tip of snout to dorsal fin 40 inches, to pectoral 24; length of dorsal along front 13, of pectoral along anterior curve 12; breadth of tail-flukes 21 (*Owen*). An adult male (Bombay) was 10 ft. 6 in. long, the pectoral 15 in. long, base of dorsal 27, expanse of flukes 27. Skull of female 18 in. long, rostrum 11, breadth of skull between orbits nearly 7.

Distribution. Indian seas. The species has been obtained at Vizagapatam and at Alibág near Bombay. I also refer to it a skull now in the Museum of the College of Surgeons, that was obtained by Mr. Holdsworth at Aripo in Ceylon, and noticed by Prof. Flower (P. Z. S. 1883, p. 488) as closely resembling *Sotalia sinensis.* There are 31–32 teeth on each side of the upper jaw. The skull is 18·75 inches long (basal length) and 8 broad.

393. **Steno? maculiventer.** *The spot-bellied Dolphin.*

Delphinus (Steno?) maculiventer, *Owen, Tr. Z. S.* vi, p. 21, pl. vi, figs. 1, 2.

Suvva, Telegu.

Teeth $\frac{27}{30}$. Pectoral and dorsal fins falcate, pectoral apparently about $\frac{1}{6}$ of total length.

Colour. Above deep shining plumbeous black, becoming paler below; from the chin to the anus ashy grey, with irregular dark spots or blotches.

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Dimensions. Length of an adult female 6 ft. 11 inches, of rostrum externally 5 in., from snout to dorsal fin 40, to pectoral 21, length of pectoral along anterior curve 15; vertical height of dorsal fin 8, length of its base 18; expanse of tail-flukes 20 (*Owen*).

Distribution. Vizagapatam.

This is a doubtful species, founded on drawings, no skull having been preserved. As already suggested, it requires comparison with *Tursiops catalania.*

Genus **DELPHINUS**, Linn. (1766).

Syn. *Eudelphinus, Prodelphinus*, Gervais (1880).

Snout long, separated by a groove from the forehead. Dorsal and pectoral fins falcate.

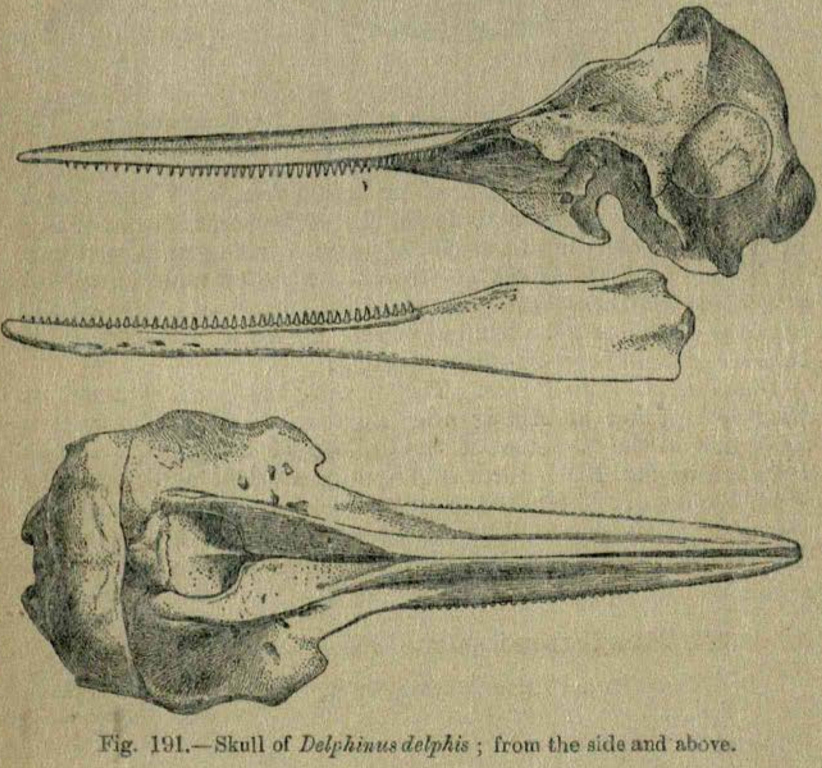

Fig. 191.—Skull of *Delphinus delphis*; from the side and above.

Rostrum long and narrow, generally about twice as long as the cranial portion of the skull. Pterygoids narrow, compressed, sharply keeled, in contact. Mandibular symphysis short. Teeth small ($\frac{1}{10}$ to $\frac{1}{8}$ inch in major diameter), acutely pointed, and numerous (41 to 65 on each side of each jaw), oval in section towards the base, the longer diameter across the jaw. Vertebræ 73 to 76; in *D. delphis* C. 7, D. 14–15, L. 21–22, C. 30–32.

I include *Prodelphinus*, which only differs in having a flatter palate.

Synopsis of Indian Species.

A. Palate with deep and broad lateral grooves proximally.
  a. Teeth $\frac{47}{46}$ to $\frac{50}{51}$ …………………… *D. delphis*, p. 587.
  b. Teeth $\frac{65}{58}$ …………………… *D. dussumieri*, p. 588.
B. Palate nearly flat; teeth $\frac{40}{40}$ …………… *D. malayanus*, p. 588.

394. **Delphinus delphis.** *The common Dolphin.*

Delphinus delphis, *L. Syst. Nat.* i, p. 108 (1766); *Flower, Tr. Z. S.* xi, p. 1, pl. i; *id. P. Z. S.* 1883, p. 500; *True, Delphinidæ*, pp. 45, 160, pl. xi, figs. 1–3; *W. Sclater, Cat.* p. 321.
Delphinus pomeegra, *Owen, Tr. Z. S.* vi, p. 23, pl. vi, fig. 3, pl. viii, figs. 1–4.

Pomigra, Tamul (Madras.)

Body slender, head small. Beak long and narrow; pectoral fins three times as long as broad, narrow in the distal half and acutely pointed.

Teeth $\frac{41}{45}$ to $\frac{50}{51}$, small. Bony palate deeply excavated on each side proximally, the median portion convex.

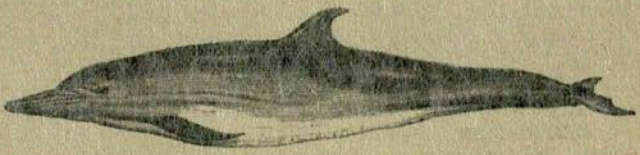

Fig. 192.—Common Dolphin, *Delphinus delphis.* (Flower, Art. Mammalia, 'Encyclopædia Britannica.')

Colour very variable. The Indian *D. pomeegra* is said to be almost black, with a rather lighter shade on the belly. In Atlantic specimens the back is usually dark grey, the underparts white or whitish, and the sides occupied by various bands of grey or fulvous.

Dimensions. Total length 7 ft. 6 in., snout to dorsal fin 39·3 inches, to pectoral 20, length of pectoral 14, breadth of flukes 20·5. Length of skull 18·4 inches, breadth between orbits 6·75, length of rostrum 11.

Distribution. Probably all tropical and temperate seas. In India only recorded from the Madras coast.

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395. **Delphinus dussumieri.** *The Indian long-nosed Dolphin.*

Delphinus longirostris, *Dussumier, Cuv. Règne An.* éd. 2, i, p. 288 (1829); *Flower, P. Z. S.* 1883, p. 503; *True, Delphinidæ*, pp. 58, 161, pl. xii, fig. 2; *W. Sclater, Cat.* p. 322 [nec *Gray, Spic. Zool.* p. 1 (1828)].

Colour and other external characters unknown.

Teeth $\frac{65}{58}$. Rostrum greatly elongate. Symphysis of mandible one fifth the length of the skull. Palatal grooves as in *D. delphis.*

Dimensions. Length of skull 19·5 inches, breadth between orbits 5·75, length of rostrum 13·25.

Distribution. Malabar coast.

The description of the type skull is copied from True. The name *longirostris* cannot stand, as there is a different species to which the name was previously given by Gray. *D. capensis*, Gray, I find, on examining the skull, is quite distinct, having only $\frac{53}{51}$ rather large teeth and a much shorter mandibular symphysis.

D. roseiventris may also occur in Indian seas. It is known from the Moluccas and Torres Straits, and is a small species, rather less than 4 feet long, with $\frac{48}{48}$ teeth, and the bony palate intermediate in form between that of typical dolphins like *D. delphis* and that of aberrant types like *D. malayanus.*

396. **Delphinus malayanus.** *The Malay Dolphin.*

Delphinus malayanus, *Lesson, Voy. Coquille, Zool.* i, p. 184, *Atlas*, pl. ix, fig. 5 (1826).

? Delphinus velox, *Dussum., Cuv. Règne An.* éd. 2, i, p. 288 (1829); *F. Cuv. Hist. Nat. Mam.* pl. 425; *Pucheran, Rev. Mag. Zool.* 1856, p. 453.

Steno attenuatus, *Gray, Zool. Ereb. & Terror*, p. 44 (1846); *id. Cat. Seals & Whales B. M.* 1866, p. 235; *Blyth, J. A. S. B.* xxviii, p. 492, footnote; *id. Cat.* p. 92.

Prodelphinus attenuatus, *Flower, List Cetacea B. M.* 1885, p. 30; *W. Sclater, Cat.* p. 324.

Prodelphinus malayanus, *True, Delphinidæ*, pp. 67, 165, pl. xvi, figs. 1, 2.

Teeth about $\frac{40}{40}$. No lateral grooves on bony palate.

Colour uniform ashy grey.

Dimensions. Total length 6 ft. 3 in., height of dorsal fin 8·5 inches, length of pectoral 13·8, expanse of tail 24. A skull is 15·5 inches long, 6 broad across the orbits; length of rostrum 9·5.

Distribution. Indian Ocean, obtained in the Bay of Bengal near the Sundarbans.

There is much confusion regarding *Delphinus malayanus*, *D. attenuatus*, and *D. frænatus* (*D. doris*, Gray), all of which have been reported from the Indian Ocean. The skulls are very similar; but True has collected evidence showing some important distinctions in

CSL

coloration—*D. malayanus* being uniform ashy, *D. attenuatus* dark above, ashy grey below, and *D. frænatus* dark above, white below, the dark parts spotted or speckled with white. The number of vertebræ is also different. The specimen described by Blyth agreed in colour with *D. malayanus*; but if the other forms deserve separation, it is probable that one or both of them will be found on the Indian coasts. *D. longirostris*, Gray, with teeth $\frac{52}{52}$, may also occur*.

Delphinus velox is not mentioned by True, and must remain a doubtful species for the present. It was founded on a specimen, one of a very numerous shoal, that was harpooned at sea between Ceylon and the Equator. The dorsal and pectoral fins were much falcate, the teeth $\frac{41}{41}$; the colour black throughout. The length of the specimen was 5 feet, the height and base of the dorsal fin each about 5·5 inches, the pectoral 10 inches long, expanse of the tail 13. The movements of these dolphins were very swift, hence the name. The type may have been a young *D. malayanus*.

Family PLATANISTIDÆ.

The last family of Cetacea is composed of three genera, each containing a single species. All are fluviatile or estuarine; two are South-American (one, *Inia*, inhabiting the river Amazons, the other, *Pontoporia*, living in the Rio de la Plata estuary), and the third, *Platanista*, is Indian. This distribution may indicate that the family, which in some respects is less specialized than other Cetaceans, was once marine and widely spread, and that the few living representatives, as in the parallel case of Ganoid and Dipnoan fishes, owe their survival to their adaptation for a life in rivers, where the struggle for existence is less severe than in the sea.

The size of the *Platanistidæ* is relatively small. Teeth are numerous in both jaws, which are long and narrow. The symphysis exceeds half the length of the mandible. The head is divided from the body by a slightly constricted neck. The cervical vertebræ are all free. The tubercular and capitular articulations of the ribs are distinct in front and blend gradually behind as in ordinary mammals. Pterygoids elongate, in contact, not involuted.

Genus **PLATANISTA**, Wagler (1830).

A long compressed beak, slightly enlarged at the extremity; dorsal fin rudimentary, replaced by a low ridge; pectoral fin

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* Owen (Tr. Z. S. vi, p. 23) calls *D. longirostris*, Gray, the Black Dolphin of the Cape and Ceylon. There is probably some confusion with *D. longirostris*, Cuv. (*D. dussumieri*, ante, p. 588), from Malabar.

GSL

triangular, fan-shaped; eye very minute, rudimentary, without a crystalline lens; blowhole longitudinal, linear. A small cæcum. No pelvic bones.

Teeth rather large, conical, circular in section, and sharp-pointed in the young, gradually becoming worn down and acquiring enlarged flattened roots. Symphysis one half (in males) to two thirds (in old females) the length of the mandible, the teeth on the two sides in the anterior part of the rostrum and mandible being so close together as almost to touch. Proximal portion of maxillæ bearing very high, longitudinal, incurved bony crests, which bend over and almost meet above. Zygomatic process of squamosal very broad. Vertebræ: C. 7, D. 10–11, L. 8–7, C. 26=51.

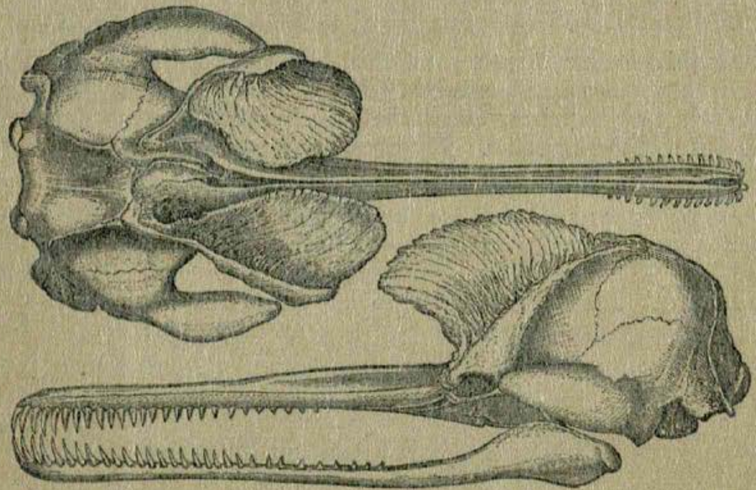

Fig. 193.—Skull of *Platanista gangetica*, young. (Copied from Sterndale.)

A full account of the anatomy, distribution, and habits of the only member of this genus has been given by Anderson.

397. **Platanista gangetica.** *The Gangetic Dolphin.*

Delphinus gangeticus, *Lebeck, Neue Schr. Ges. nat. Freunde Berl.* iii, p. 280 (1801); *Roxburgh, As. Res.* vii, p. 170, pl. v (1801).
Platanista gangetica, *Gray & Hardw. Ill. Ind. Zool.* ii, pl. xxiv; *Eschricht* (translated by Wallich), *A. M. N. H.* (2) ix, pp. 161, 279, pls. v–vii; *Blyth, Cat.* p. 92; *Jerdon, Mam.* p. 159; *Anderson, An. Zool. Res.* p. 417, pls. xxv, &c.; *W. Sclater, Cat.* p. 315.
Platanista indi, *Blyth, J. A. S. B.* xxviii, p. 493; *id. Cat.* p. 92; *Jerdon, Mam.* p. 159.

Sús, Súsú, H.; *Súsúk, Sishúk*, Beng.; *Sisúmar*, Sans.; *Bhulan, Súnsar*, Sind.; *Hiho, Seho*, Assam; *Húh*, Sylhet.

Rostrum much shorter in males than in females. Teeth about $\frac{30}{30}$ on each side, generally rather more below than above.

Colour blackish throughout.

Dimensions. Very variable; adults usually 7 to 8 feet long, but a specimen from the Jumna in the Allahabad Museum is said to measure 12 feet. Females are larger than males. In a female 89 inches long the anterior border of the pectoral fin measured 12·5, and the expanse of the tail 19. A large female skull measured 27·25 inches in basal length and 10·25 in greatest breadth; a large male skull 19·4 by 8·9.

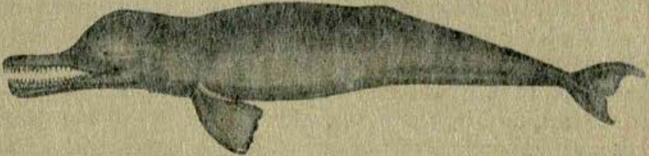

Fig. 194.—*Platanista gangetica* (Flower, Art. Mammalia 'Encyclopædia Britannica').

Distribution. Indus, Ganges, and Brahmaputra, with all their larger tributaries, from the sea to the base of the mountains. This dolphin is common in tidal waters, but never enters the sea.

Habits. According to Anderson the Gangetic dolphin is not gregarious, although several individuals may be seen about the same part of the river. It keeps chiefly to the deeper channels and is probably migratory to some extent, as none are seen in the Hoogly near Calcutta during the hot season from March to June, though many may be noticed in the cold months from October to March. In the rains (June to October) this dolphin undoubtedly remains in the tidal waters, for it is frequently captured, though it is seldom observed. It rises to breathe like other dolphins, remaining but a very short time at the surface. Sometimes in the cold months it throws itself out of the water.

This cetacean is quite blind; sight would be useless in the thick muddy waters of the Indus at all times of the year, and of the Ganges and Brahmaputra at most seasons. Its food consists of fish and prawns, and amongst the former Anderson found the remains of mud-haunting Siluroids. Doubtless these are captured by the *Platanista* feeling for then on the mud with its snout.

The period of gestation is said to be eight or nine months; the young, almost always one in number, very rarely two, are born between April and July, and it is stated that the young dolphin at times holds on by its mouth to the base of the mother's pectoral fin. These details require confirmation.

Platanista is captured by fishermen in parts of the country either by nets or by harpooning. The flesh is eaten by particular castes, and the oil is used for burning and other purposes.

Order SIRENIA.

The Manatees and Dugongs, formerly classed with the *Cetacea*, and subsequently assigned by De Blainville and others to the *Ungulata* (or *Pachydermata*), are now placed in a separate order, the *Sirenia*, which has certainly no affinity to Cetaceans and very little, if any, to Ungulates. The *Sirenia* resemble *Cetacea* in their fish-like form, in the absence of external hind limbs and of a distinct sacrum, and in the rudimentary condition of the pelvis, in the horizontal expansion of the tail to form a swimming organ, in the pectoral limbs being converted into paddles without separate digits, in the small eyes, and in the want of an ear-conch. On the other hand, the head is of moderate size and rounded, the nostrils are always separate, valvular, and anteriorly situated, the mouth small and the teeth, in all living forms, of two kinds, incisors and molars; there is no dorsal fin; and hairs or bristles occur on the lips at all ages and are sometimes scattered over the body. The muzzle is truncated, and horny plates, doubtless used in mastication, are developed on the anterior portion of the palate and of the lower jaw.

The bones are dense and massive. The skull is peculiarly formed, but very unlike that of any Cetacean. The anterior narial aperture is large and high in position, and the nasal bones are generally wanting in living forms. There is a thick rostrum, chiefly formed by the premaxillaries. The flat ends of the bodies of the vertebræ do not ossify separately, as in nearly all other mammals. The radius and ulna are generally united together at both ends. The digits are five in number, and the phalanges, which are never more numerous than in ordinary Mammalia, are flattened. The stomach is compound, the intestines long, and there is a cæcum. The testes are abdominal, the uterus bicornuate, and the placenta non-deciduous and diffuse. The mammæ are two in number and are pectoral and postaxillary.

The order contains only one family and two living genera, which are purely herbivorous, feeding on aquatic plants, and which inhabit shallow seas, estuaries, and rivers. They are never found out at sea, like Cetacea, nor do they ever voluntarily go ashore.

Family MANATIDÆ.

Characters of the order. Of the two living genera one, *Manatus*, is found in rivers and estuaries on both sides of the tropical Atlantic, the other, *Halicŏre*, inhabits the coasts of the Indian Ocean.

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A third genus, *Rhytina*, formerly lived on the shores of Behring's Island, but has been extinct for more than a century.

In Flower and Lydekker's 'Introduction to the Study of Mammals,' each of the genera named is classed as the type of a family.

Genus **HALICORE**, Illiger (1811).

Nostrils on upper part of muzzle. Tail crescent-shaped, concave behind. Pectoral fins ovate. No nails on digits.

The thick rostrum and the mandibular symphysis bent downward. Teeth altogether, i. $\frac{4}{3}$, m. $\frac{5-5}{5-5}$; but only two upper incisors are found in adults and two or three molars on each side above and below. The adult incisors are rootless, straight, tusk-like, large in the male, not exserted in the female. The anterior molars are circular in section, and increase in size backward, the last appears as if formed of two cylinders joined together; the anterior molars fall out before the posterior molar appears above the gum, All are rootless and destitute of enamel.

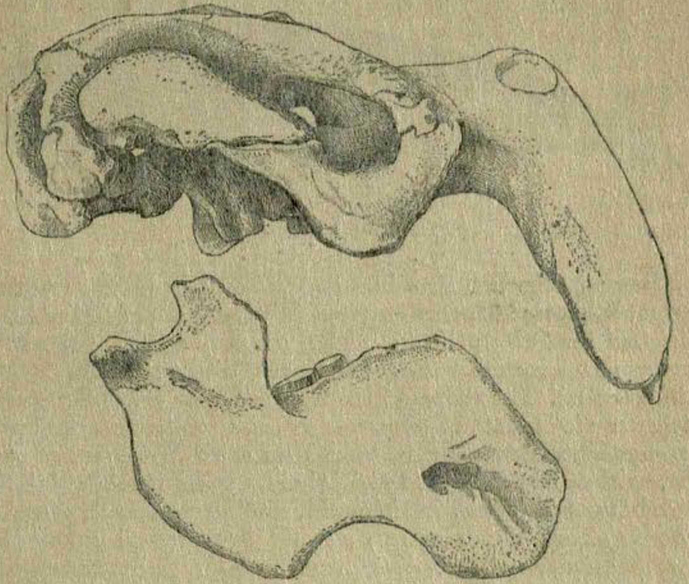

Fig. 195.—Skull of *Halicore dugong*.

Three species have been described; but it is doubtful whether *H. tabernaculi*, from the Red Sea, and *H. australis*, from Australia, are distinct from the Indian species *H. dugong*.

398. **Halicore dugong.** *The Dugong or Duyong.*

Trichechus dugung, *Erxleben, Syst. Reg. An.* p. 599 (1777).
Halicore dugong, *Illiger, Prod.* p. 140; *Gray & Hardw. Ill. Ind. Zool.* ii, pl. xxiii; *Blyth, J. A. S. B.* xxviii, pp. 271, 483, 494; *id. Cat.* p. 143; *id. Mam. Birds Burma*, p. 53; *Jerdon, Mam.* p. 311; *W. Sclater, Cat.* p. 326.
Halicore indicus, *Desm. Mam.* p. 509; *Cantor, J. A. S. B.* xv, p. 274; *Kelaart, Prod.* p. 89.

Talla mala, Muda ura, Cing.; *Duyong, Parampuan laut,* Malay.

Colour either bluish grey throughout or the lower parts whitish or white.

Dimensions. Extreme length of adults 8 to 9 feet, usually 5 to 7; much larger dimensions are given in books, but are open to doubt.

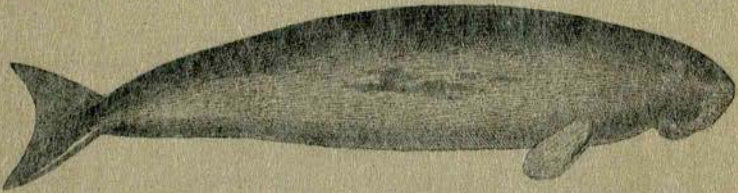

Fig. 196.—*Halicore dugong.*

In a large specimen 8 ft. 6 in. long and 6 ft. in circumference, the pectoral fins were 16 inches long and 8 inches broad, and the breadth of the tail from tip to tip 31. The skull of a male from Ceylon measures 14·5 inches in basal length and 8·5 in breadth.

Distribution. The shores of the Indian Ocean from E. Africa to Australia for about 15 degrees on each side of the Equator. Dugongs have been observed on the coast of Malabar, the north-west coast of Ceylon from the Gulf of Calpentyn to Adam's Bridge, around the Andaman Islands, and in the Mergui Archipelago.

Habits. Formerly dugongs were said to be found in large herds of some hundreds of individuals, and to be in places so tame as to allow themselves to be handled. As their flesh is by all accounts excellent and their fat yields a clear limpid oil of great value, they have everywhere been hunted and are now in most places rare. They are said to be slow in their movements and unintelligent. Their food consists of marine algæ. They haunt shallow bays, salt-water inlets, and mouths of estuaries, but do not, like the Manati, ascend rivers. The female gives birth to but one young at a time, and is said to hold it with her pectoral fin. Some writers have suggested that the dugong has given rise to the myth of the mermaid (hence, indeed, the name *Halicore*); but it should be remembered that stories of beings half man or woman, half fish, are as common in temperate as in tropical seas, and that some of them are more ancient than any European knowledge of the dugong.

Order EDENTATA.

The last order of placental mammals, containing the Sloths, Anteaters, Armadillos, Cape Anteaters, and Pangolins or Scaly Anteaters, is quite as distinct from all other mammalian orders as the Cetacea and Sirenia are; but it is far less homogeneous than either, there being very few structural characters common to all the different suborders included in it, except the absence of teeth in the front of the jaw. In some of the Edentates, as in the only Indian genus belonging to the order, teeth are entirely wanting; when teeth are present they are rootless, destitute of enamel, and similar to each other in shape, and, with a single exception (the genus *Tatusia*, an armadillo), there are no milk-teeth. All known species of Edentates are terrestrial or arboreal and resemble ordinary mammals in external form.

As only one genus is found in India it is unnecessary to describe here the very great structural differences of the various suborders and families. These are, according to Flower's latest classification (P. Z. S. 1882, p. 358):—I. Suborder Pilosa, containing the families (1) *Bradypodidæ* and (2) *Myrmecophagidæ*, both South-American; II. Loricata, with the family (3) *Dasypodidæ*, also South-American; III. Squamata, consisting of the (4) *Manidæ*, Asiatic and African; and IV. Tubulidentata, containing the (5) *Orycteropodidæ*, confined to Africa.

Suborder *SQUAMATA.*

No teeth. The whole upper surface and the sides of the body and tail covered with large imbricate horny scales. Limbs short, 5 toes on each foot. Tongue long, vermiform, capable of great protrusion. Uterus bicornuate. Placenta diffused and non-deciduate. No cæcum.

A single family with only one living genus.

Family MANIDÆ.

Genus **MANIS**, Linn. (1766).

Head small, long and pointed in front; mouth very small. Eyes small. Ear-conch small or rudimentary. The upper part of the head, the back and sides of the body, the whole tail, and the outside

GSL

of the limbs covered with large imbricate scales; lower surface of head and body, sides of head, and inner surface of limbs scaleless, scantily covered with hair. Generally there are a few coarse hairs between the scales. All the toes bear slightly curved claws, those on the fore feet longer than those on the hind, third claw the longest on all feet, claws of pollex and hallux short. In walking, the dorsal surfaces and outer sides of the phalanges belonging to the two outer digits of the fore feet rest on the ground, so that the animal walks with its fore toes doubled under the feet. The hind feet are plantigrade and, as a rule, rest on the ground normally.

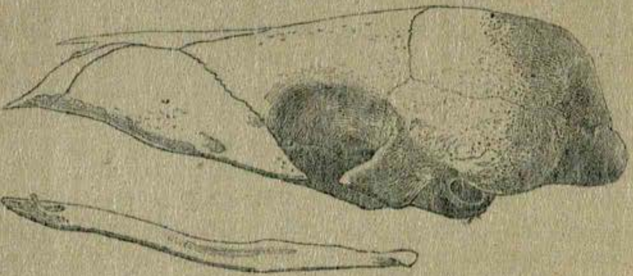

Fig. 197.—Skull and lower jaw of *Manis pentadactyla.*

The skull is of very peculiar shape; it is rounded behind, and diminishes gradually in front, being almost conical; it is quite smooth, without any crests. The zygomatic arch is imperfect, there being no malar bone. There is no distinction between the orbits and the temporal fossæ. Palate long and narrow, produced far backwards; the pterygoids extend backwards to between the tympanics, each of which forms a small crescentic bulla. Rami of mandible very slight and straight, without angle or coronoid process, but each ramus bears anteriorly on its upper border a small pointed process projecting outwards. No clavicles. No third trochanter to the femur. Ungual phalanges bifid distally. Two pectoral mammæ. Stomach with thick muscular walls, especially towards the pyloric end, and with a special gland near the middle of the great curvature. A gall-bladder present.

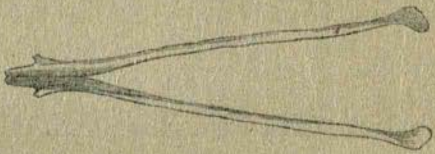

Fig. 198.—Lower jaw of *Manis pentadactyla*, from above.

The Pangolins or Scaly Anteaters are burrowers and live entirely on ants and termites, the long extensile tongue being used for the capture of the insects. They roll themselves into a ball for defence, and exhibit an enormous muscular power that defies any ordinary attempt to unroll them.

The genus inhabits the Oriental and Ethiopian regions, the African forms being rather more numerous than the Asiatic and exhibiting more variety. The three Asiatic species agree with each other in having the tail tapering, the limbs entirely covered with scales outside, and the middle row of scales above the tail continuous to the end. All three occur within our area.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Fore claws about twice length of hind claws.
  a. 11 to 13 rows of scales round body ...... *M. pentadactyla*, p. 597.
  b. 15 to 18 rows of scales round body ...... *M. aurita*, p. 599.
B. Fore claws but little longer than hind claws. *M. javanica*, p. 599.

A characteristic terminal phalanx of a large species of *Manis*, closely allied to the African *M. gigantea*, has been found in the Pleistocene cave-deposits of Kurnool. Another phalangeal bone, referred to the genus *Macrotherium*, has been described from the Lower Siwalik of Sind; but this genus, I am informed by Mr. Lydekker, is probably ungulate, not edentate as formerly supposed.

399. **Manis pentadactyla.** *The Indian Pangolin.*

Manis pentadactyla, *L. Syst. Nat.* i, p. 52, partim (1766); *Sykes, P. Z. S.* 1831, p. 104; *Horsfield, Cat.* p. 196; *Blyth, J. A. S. B.* xi, p. 453; xvi, p. 1273, pl. lv; *id. Cat.* p. 179; *Jerd. Mam.* p. 314; *Anderson, An. Zool. Res.* p. 341, pl. xxiv, figs. 1, 2; *W. Sclater, Cat.* p. 330.

Manis brachyura, *Erxl. Syst. Reg. An.* p. 98 (1777), partim; *Blyth, J. A. S. B.* xii, p. 181.

Manis crassicaudata, *Geoffr. St.-Hilaire, Cat. Mam.* p. 213, partim (1803); *Elliot, Mad. Jour. L. S.* x, p. 218; *Tickell, J. A. S. B.* xi, p. 221; *Kelaart, Prod.* p. 74.

Pholidotus indicus, *Gray, P. Z. S.* 1865, p. 368.

Bájra-Kit, Sanscr. and H.; *Bájra Kapta, Suráj-mukhi, Silu, Sál Sálú, Sakunphor*, H.; *Kishaur*, Pushtu; *Challa, Mirún*, Sind; *Shálma*, Bauri; *Armú*, Kol; *Thiriya, Kauli-mah, Kauli-manjra, Kassoli-manjur*, Mahr.; *Alawa*, Tel.; *Alangú*, Tam. and Mal.; *Kabalaya*, Cing.; *Banrohu* (jungle carp), Deccan, &c.; *Keyot-mach*, Rangpore; *Kat-pohu*, Bengal.

Body and tail stout. Claws of fore feet very long, the middle fore claw double the length of the middle hind claw. Scales on body large, none keeled, as a rule, in adults. There are 11 to 13 longitudinal rows of scales round the body, 14 to 17 in the median (longitudinal) row above the tail, the tail being taken to commence where the scales at the sides become angulate. The scales are about twice as broad as in the other two Indian species.

Colour of scales light yellowish brown throughout; naked skin flesh-coloured, nose more livid.

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Dimensions. Head and body of a male 24·5 inches, tail 18, of another specimen 26 and 18. Ceylon specimens appear to have longer tails; Kelaart gives head and body 23·5, tail 22·5, Hornaday for a female 19 and 17. A skull measures 3·25 in basal length, greatest breadth 1·75. Weight of adults 20 to 27 lb.; of a large specimen 42, according to Kelaart.

Distribution. India proper and Ceylon. This species is found on the mainland from Peshávar (Stewart, J. A. S. B. xxxii, p. 235) and Sind (probably also Baluchistan) to Bengal and Orissa, and from the base of the Himalayas to Cape Comorin. It is not reported from any part of the Himalayas, though it probably occurs in the lower ranges to the westward. Jerdon's statement that it was found by Hodgson in Nepal appears due to some mistake. It occurs on the Shevroy hills, Madras Presidency, up to at least 3500 feet above the sea.

Habits. Good accounts have been given by Elliot and Tickell. Like other species of the genus, this pangolin, as a rule, only moves about at night, and hides during daylight in burrows dug by itself or amongst rocks. I, however, once in Orissa found an adult moving about in jungle some time after sunrise. The burrow, according to Elliot, descends in a slanting direction to a depth of from 8 to 12 feet below the surface and ends in a large chamber about 6 feet in circumference, in which the pangolins live in pairs, with, at times, one or two young. The entrance to the burrow is closed with earth when the animals are in it.

The food consists of various kinds of ants and termites, especially of the latter. The ants' nests are torn open by the powerful claws of the Manis, which thrusts its long tongue into the passage-ways and then withdraws it with numerous ants adhering to it. This animal also drinks (in confinement) by rapidly extending and withdrawing its tongue; whether it drinks frequently or at all in the wild state may be questioned, for it often inhabits places where no water is procurable. Stones have repeatedly been found in the gizzard-like stomach and may aid, as in birds, in triturating the food. Blyth gave to a Manis that had been starved for some time chopped raw meat and cooked egg and rice, on which the animal fed freely after nightfall, but it died soon after, probably from repletion.

The only sound known to be produced by this animal is a hissing noise that it makes when annoyed. In confinement it soon grows tame, but there is often some difficulty in feeding it. It walks very slowly, with the back well arched, and is in the habit of standing up on its hind feet with the body not vertical, but inclined forward.

The breeding-habits are imperfectly known. A single young one is generally produced, more rarely two, in the Deccan from January to March, according to Elliot. In the Shevroy hills, however, a female kept for some time by Mr. W. H. Daly produced a young one weighing 1 lb. on July 11th.

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400. **Manis aurita.** *The Chinese Pangolin.*

Manis pentadactyla, *L. Syst. Nat.* i, p. 52 (1766), partim.
Manis aurita, *Hodgson, J. A. S. B.* v, p. 234 (1836); *Blyth, Cat.* p. 179; *Jerdon, Mam.* p. 316; *Anderson, An. Zool. Res.* p. 352, pl. xxiv, figs. 3, 4; *Jentink, Notes Leyd. Mus.* iv, p. 202; *W. Sclater, Cat.* p. 330.
Manis javanica, *Blyth, J. A. S. B.* xi, p. 454, xvi, p. 1274, *nec Desmarest.*

Bájarkít, H.; *Sálak*, Khas; *Kwengnya*, Newári.

Body and tail more slender than in *M. pentadactyla* and scales much smaller and darker coloured. Fore claws long; middle fore claw twice as long as middle hind claw. Scales without keels in adults or only 3 or 4 outer rows on body keeled. Round the body the longitudinal rows are 16 to 18 in number, usually 17; 16 to 20 scales in the median row above the tail. More hair between the scales than in other Indian forms, and the ear-conch is more developed.

Colour. Scales dark brown throughout in adults, sometimes with pale concentric bands in young animals; naked parts flesh-coloured.

Dimensions. Head and body 19 to 23 inches, tail 13 to 15. A skull measures 3·5 in basal length, 1·6 in greatest breadth. Weight of adults 15 to 17 lb.

Distribution. Himalayas as far west as Nepal, at moderate elevations, Assam, hills north of Bhámo, Karennee, and Southern China (Amoy, Hainan, Formosa).

Habits, so far as known, similar to those of the last species.

401. **Manis javanica.** *The Malay Pangolin.*

Manis javanica, *Desmarest, Mamm.* p. 377 (1822); *Cantor, J. A. S. B.* xv, p. 259; *Horsfield, Cat.* p. 197; *Blyth, Cat.* p. 179; *Anderson, An. Zool. Res.* p. 352, pl. xxiv, figs. 5–8; *Jentink, Notes Leyd. Mus.* iv, p. 199; *W. Sclater, Cat.* p. 331.
Manis leptura, *Blyth, J. A. S. B.* xi, p. 454, xvi, p. 1273; *id. Cat.* p. 180.
Manis leucura, *Blyth, J. A. S. B.* xvi, p. 1274.
Pangolinus leucurus, *Blyth, Mam. Birds Burma*, p. 53.

Theng-khwe-khyat, Burmese; *Pangoling*, *Tangiling*, Malay.

Form more slender than in either of the preceding species and tail generally longer. Fore claws but little longer than the hind, never more than half as long again. Scales longer, more pointed behind, and rather less closely adpressed, the posterior edges chipped, not worn, and with a median keel frequently visible in adults, especially on the tail, sides, and limbs; 15 to 19 rows (usually 17) round the body, 20 to 30 (usually 24 to 27) scales in the median row above the tail.

Colour dark brown, the sides and the terminal portion of the tail sometimes whitish, and all the scales in a few instances particoloured. Naked skin whitish.

Dimensions. A large male measured, head and body 21·5 inches, tail 20; basal length of a skull 4·1, greatest breadth 1·75.

Distribution. From Sylhet and Tipperah, and from the lower ranges near Bhámo, throughout Burma, Cochinchina, and Cambodia, the Malay Peninsula, Sumatra, Java, and Borneo to Celebes. I have not been able to ascertain whether this species or *M. aurita* inhabits the hills south of Assam.

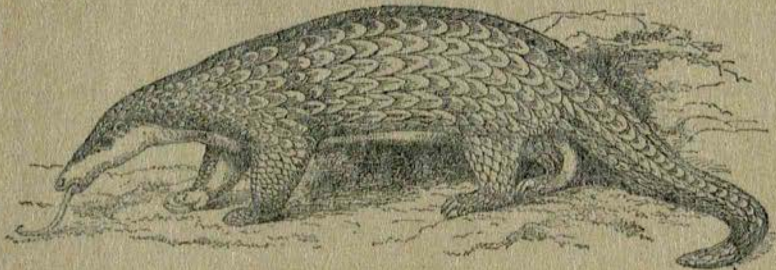

Fig. 199.—*Manis javanica.* (From a drawing by Col. Tickell.)

Habits. From Tickell's MS. notes it may be inferred that this species sometimes turns both fore and hind claws under the feet in walking. It is probably less of a burrower than the other two species, as its fore claws are much smaller and its scales less worn. S. Müller states that in Java it ascends trees and conceals itself in fissures, especially in several kinds of fig-tree; but it also burrows in the earth, though it is rarely found amongst rocks. Similar statements as to its habits in Borneo are made by Motley and Dillwyn (Nat. Hist. Labuan, p. 51).

GSL

APPENDIX AND ERRATA.

Introduction, p. iv, line 27, *for* 'some of these forms' *read* 'some of the Ethiopian and Palæarctic types.'

P. 1. Add to the characters of Mammalia the following:—

The occipital condyle is double. Each ramus of the lower jaw is composed of a single piece and articulates directly with the squamosal, no quadrate bone intervening.

Pp. 7, 9. The hoolock, according to Mr. Sterndale's observations, sometimes drinks in the ordinary way, sometimes by dipping its hand in water, and licking the drops off its fingers.

P. 23, line 10 from bottom, *for* 'longer' *read* 'shorter.'

P. 42. This footnote, I am informed by Mr. Theobald, is not quite accurate. The collection of skulls was made over by Mr. Theobald to Dr. Oldham without reservation and was presented by the latter to the British Museum. The specimens are therefore correctly labelled as presented by Dr. Oldham. The essential fact is that the collection was made by Mr. Theobald, as stated.

P. 50, line 9, *for* 'heel' *read* 'keel.'

P. 54, lines 11 and 13 from bottom, *for* 'cusp' *read* 'lobe.'

P. 60. A tiger killed by Mr. Hornaday in the Anaimalai forest, South India ('Two Years in the Jungle,' p. 159), measured 9 feet 8½ inches long to the end of the tail-vertebræ, and weighed 495 lb. Weights of Cooch Behar tigers varying from 450 to 493 lb. are given in the 'Asian' (April 3rd, 1891, p. 3). There can be no question as to Mr. Hornaday's accuracy, and it is evident that some tigers are much heavier than those weighed by Elliot and Sanderson. Forsyth's estimate of 450 to 500 lb. is clearly not excessive as it appeared. Tigresses 9 feet 11 inches and 10 feet 2 inches long are recorded by Mr. F. A. Shillingford ('Asian' Sept. 18th, 1891).

P. 112, line 1, for '*P. zeylonensis*' read '*P. aureus.*'

P. 143. It would be better to adopt the spelling *deccanensis* for the specific name of the wild dog.

Pp. 182–188. Mr. Thomas has published (P. Z. S. 1889, p. 190) some important notes on the characters and synonymy of different species of otter. He has come to the conclusion that the type of *Lutra aureobrunnea* is, as I suggested, a dyed skin of a young *L. vulgaris*, and he is convinced that the skull described by Gray as *Barangia nepalensis* belonged to a female *L. vulgaris*, dwarfed by captivity. Thus these species may be entirely dismissed as fictitious, a conclusion in which I agree. The other three Indian species remain as described in the text; but Mr. Thomas shows that the clawless otter, *Lutra leptonyx* of Horsfield (1824), must take the earlier title of *L. cinerea*, Illiger (1815). He applies to the otter called in the present work *L. ellioti* the name *L. barang*, F. Cuv. (1823). But Dr. Scully, being in Paris, re-examined Cuvier's type of *L. barang* and found that it belonged to *L. vulgaris*. As, however, Mr. Thomas has also shown, the otter named by Dr. Gray *L. macrodus* (P. Z. S. 1865, p. 128), and supposed to have been brought from Brazil, is really the smooth Indian otter, and consequently this name will have to be used. The following is the revised nomenclature:—

No. 92, p. 182. *Lutra vulgaris.*
No. 93, p. 185. *L. macrodus.*
No. 94 must be omitted altogether.
No. 95, p. 187. *Lutra cinerea.*

P. 221. I have now seen a specimen of No. 110, which, following Dobson, I called *Gymnura suilla.* I regard it as generically distinct from *Gymnura*, and it should, I think, stand as *Hylomys suillus.* Under these circumstances the name to fig. 59, p. 222, will not need correction.

P. 227. The last footnote is erroneous and due to a mistake.

P. 240. I was informed by Dr. Day, shortly before he died, that the type specimen of *Crocidura dayi* was from Trichur in Cochin, and was brought to him by a tank-digger.

P. 253, line 2, for '*Scotophilus*' read '*Nycticejus.*'

P. 265, No. 142. *Cynopterus blanfordi,* Thomas (not Doria & Thomas). The description has appeared, Ann. Mus. Civ. Genova, (2*a*) x, p. 884.

P. 317. Add after No. 190:—

Vesperugo tylopus, *Dobson, P. Z. S.* 1875, p. 473; *id. Mon. As. Chir.* p. 114; *id. Cat. Chir. B. M.* p. 236.

This bat belongs to the subgenus *Vesperugo*, with two upper premolars on each side, but has the lower surface of the basal half of the thumb and the soles of the feet furnished with fleshy pads as in *V.* (*Vesperus*) *pachypus*, p. 307. See P. Z. S. 1876, p. 532, pl. lv, figs. 3, 3*a*. Forearm 1·2 inches.

Originally described from North Borneo, recently found by Mr. L. Fea in Karennee.

P. 325. Add after No. 198:—

Harpyiocephalus auratus, *M.-Edw. Rech. Mam.* p. 250, pl. xxxvii *b*, fig. 1, and pl. xxxvii *c*, fig. 2 (1872); *Dobson, Mon. As. Chir.* p. 155; *id. Cat. Chir. B. M.* p. 279.

In this species the first upper premolar is smaller than the second, as in *H. suillus* and *H. tubinaris*, but the upper third of the outer margin of the ear-conch is convex or straight. Each nostril forms a distinct tube directed sublaterally, with a circular aperture marked by a very small notch on the outer and upper margin. Forearm 1·1 inch. Colour of fur black, above with golden-yellow tips, below with white.

Described from Eastern Tibet. A dried skin has been discovered by Mr. Thomas amongst some specimens from Sikhim formerly belonging to me.

Also add:—

Harpyiocephalus feæ, n. s., *Thomas, Ann. Mus. Civ. Genova,* (2*a*) x, p. 884; thus described:—

"Allied to *H. auratus*, M.-Edw., but distinguished by the colour being brown instead of golden-yellow, by the smaller nasal tubes, and by having the forearms, hind limbs, and posterior edge of the interfemoral membrane almost naked. Anterior lower premolar very markedly shorter than the canine. Distinguished from *H. leucogaster* by its smaller size, smaller ears, and by the inner upper incisor not being longer than the outer. Forearm 29 mm (1·14 inches)." Found by Mr. L. Fea in Karennee.

P. 335. *Vespertilio dobsoni.* Mr. Thomas informs me that he finds a dried skin in the small Sikhim collection already mentioned.

P. 413. *Mus chiropus,* Thomas, described, Ann. Mus. Civ. Genova, (2*a*) x, p. 884.

P. 463. It should have been noticed in the text that the identity of the Sumatran and Indian elephant was conclusively demonstrated by Falconer.

ALPHABETICAL INDEX.

abietum (Martes), 160.
abramus (Vesperugo), 313.
abusalam (Tursiops), 581.
Acanthion, 441.
Acanthochœrus, 441.
Acanthomys, 426.
Acomys, 426.
acontium (Alactaga), 392.
acuticornis (Panolia), 541.
adversus (Vespertilio), 320, 337.
ægagrus (Ægoceros), 502.
ægagrus (Capra), 502.
Æluroidea, 53.
Ælurus, 189.
æquicaudalis (Mus), 406.
affinis (Cervus), 537.
affinis (Felis), 86.
affinis (Rhinolophus), 274.
affinis (Sus), 560.
affinis (Vesperugo), 311.
africanus (Vespertilio), 334.
agilis (Hylobates), 9.
Ailurus, 190.
Alactaga, 391.
albicornis (Cervus), 543.
albidiventris (Mus), 416.
albinus (Presbytis), 35.
albinus (Sorex), 234.
albipes (Sciurus), 374.
albipes (Semnopithecus), 31.
albiventer (Pteromys), 363.
albocinereus (Semnopithecus), 41, 42.
albogularis (Meles), 180, 181.
alboniger (Sciuropterus), 367.
alborufus (Pteromys), 365.
albulus (Erinaceus), 219.
alexandrinus (Mus), 406.
alopex (Canis), 153.
alopex (Vulpes), 153.
alophus (Hystrix), 444.
alpina (Corsira), 230.
alpina (Mustela), 168.
alpinus (Cyon), 144.
alpinus (Lagomys), 459.
alpinus (Putorius), 168.
Alticola, 430.
amboinensis (Hipposiderus), 290.
amboinensis (Phyllorhina), 290.
ammon (Ovis), 494.
ammonoides (Ovis), 494.
Ammotragus, 493.
amplexicaudata (Cynonycteris), 261.
amplexicaudata (Xantharpyia), 261.
anchises (Semnopithecus), 27.
andamanensis (Macacus), 18.
andamanensis (Mus), 406.
andamanensis (Rhinolophus), 275.
andamanensis (Sus), 562.
andersoni (Herpestes), 123.
andersoni (Vesperugo), 303.
annectans (Pipistrellus), 316.
annectens (Vesperugo), 316.
Anteaters, Scaly, 595.
Antelopes, 517, 521.
Anthropoidea, 3.
Antilope, 521.
Anurosorex, 244.
Aonyx, 181, 188.
Apes, 4.
arabica (Antilope), 526.
aranea (Crocidura), 243.
araneus (Sorex), 243.
Arctictis, 117.
Arctogale, 114.
Arctoidea, 156.
arctoides (Macacus), 17.
Arctomyinæ, 388.
Arctomys, 388.
Arctonyx, 178.
arctus (Ursus), 194.
argali (Caprovis), 494.
argentatus (Semnopithecus), 39.
arianus (Mus), 416.
aristotelis (Cervus), 543.
aristotelis (Rusa), 543.
armiger (Hipposiderus), 283.
armigera (Phyllorhina), 283.
arna (Bubalus), 491.
arnee (Bos), 491.
arni (Bubalus), 491.
Artiodactyla, 479.
Arvicola, 429.
aryabertensis (Lepus), 450.
Asellia, 281.
asiaticus (Mus), 406.
Asinus, 470.

GSL

Ass, Wild, 470.
assamensis (Anurosorex), 244.
assamensis (Macacus), 15.
assamensis (Pachyura), 241.
assamensis (Pteropus), 257.
assamensis (Sciurus), 381.
asseel (Bibos), 484.
astutus (Putorius), 171.
ater (Hipposideros), 289.
aterrimus (Sorex), 229.
Atherura, 445.
atratus (Hipposideros), 289.
atratus (Nycticejus), 306.
atratus (Sorex), 240.
atratus (Vesperugo), 306.
atridorsalis (Sciurus), 382.
attenuatus (Prodelphinus), 588.
attenuatus (Steno), 588.
aurata (Felis), 75.
auratus (Harpyiocephalus), 328, 602.
auratus (Vespertilio), 335.
aureobrunnea (Lutra), 186, 601.
aureus (Arctomys), 391.
aureus (Canis), 140.
aureus (Cervulus), 532.
aureus (Cervus), 532.
aureus (Hipposiderus), 287.
aureus (Macacus), 21.
aureus (Paradoxurus), 110.
aurita (Manis), 599.
auritus (Erinaceus), 219.
auritus (Lagomys), 457.
auritus (Plecotus), 297.
auriventer (Mustela), 169.
auropunctata (Mangusta), 121.
auropunctatus (Herpestes), 121.
auropunctatus birmanicus (Herpestes), 122.
austenianus (Pipistrellus), 310.
australis (Halicore), 593.
australis (Miniopterus), 342.
Axis, 534.
axis (Cervus), 546.
axis major (Cervus), 545.
axis unicolor (Cervus), 545.

bactriana (Alactaga), 392.
bactrianus (Camelus), 558.
bactrianus (Mus), 414.
bactrianus (Spermophilus), 391.
Badgers, 172.
badius (Mus), 402.
badius (Rhizomys), 438.
bahrainja (Cervus), 538.
Balænidæ, 563.
Balænoptera, 566.
Bandicoot, 425.
bandicota (Mus), 425, 426.
bandicota (Nesocia), 425.
banteng (Bos), 489.
Banting, 489.
banting (Bibos), 489.
barang (Lutra), 187, 601.
Barangia, 181, 187, 601.
Bárasingha, 538.
Barbastellus, 298.
barbei (Presbytis), 39.
barbei (Sciurus), 386.
barbei (Semnopithecus), 39.
barclayana (Nesokia), 423.
barclayanus (Mus), 423.
Barking Deer, 532.
Bats, 251.
Bears, 193.
beavanii (Mus), 416.
beddomei (Crocidura), 236.
belangeri (Cladobates), 210.
belangeri (Nycticejus), 320.
belangeri (Tupaia), 210.
bengalensis (Arvicola), 423.
bengalensis (Canis), 148.
bengalensis (Cynalopex), 148.
bengalensis (Felis), 78.
bengalensis (Hystrix), 444.
bengalensis (Nesocia), 423.
bengalensis (Nycticebus), 44.
bengalensis (Nyctinomus), 354.
bengalensis (Sus), 560.
bengalensis (Viverra), 100.
bengalensis (Vulpes), 148.
bennetti (Antilope), 526.
bennetti (Cynogale), 119.
bennetti (Gazella), 526.
bennetti (Tragops), 526.
berdmorei (Mus), 410.
berdmorei (Myotis), 320.
berdmorei (Sciurus), 387.
Bezoar, 503.
bezoartica (Antilope), 521.
bezoartica (Capra), 503.
Bhálú, 142.
Bharal, 499.
Bibos, 483.
bicolor (Hipposiderus), 289.
bicolor (Phyllorhina), 289.
bicolor (Sciurus), 373.
bicolor (Tapirus), 478.
biddulphi (Lepus), 452.
bidiana (Crocidura), 238.
binturong (Arctictis), 118.
birmanicus (Herpestes), 122.
Bison, 483.
Blackfish, 577.
blanfordi (Arvicola), 432.
blanfordi (Cynopterus), 265, 602.
blanfordi (Erinaceus), 215.
blanfordi (Microtus), 432.
blanfordi (Mus), 411.
blanfordi (Ovis), 497.
blanfordi (Sciurus), 379.
blanfordi (Vespertilio), 337.
blanfordi (Vesperugo), 317.
blanfordii (Crocidura), 234.
blepotis (Miniopterus), 342.
Blue bull, 517.
blythi (Arvicola), 432.
blythi (Balænoptera), 567.
blythi (Capra), 502.
blythi (Microtus), 432.
blythianus (Mus), 423.

CSL

blythii (Ceratorhinus), 476.
blythii (Crocidura), 234.
blythii (Hipposiderus), 287.
blythii (Sciurus), 381.
blythii (Vespertilio), 334.
Boar, Wild, 560.
bobac (Arctomys), 388, 389, 390.
bondar (Paradoxurus), 106.
booduga (Leggada), 416.
boops (Megaptera), 568.
borealis (Balænoptera), 566.
borealis (Vesperugo), 305.
Bos, 483.
Boselaphus, 517.
Bottle-nose, 573.
Bovidæ, 482.
bowersi (Mus), 410.
brachyota (Phyllorhina), 287.
brachyotus (Cynopterus), 264.
brachysoma (Cynopterus), 264.
brachyura (Manis), 597.
brachyura (Nesocia), 423.
brachyurus (Herpestes), 130.
brachyurus (Leopardus), 73.
brevicaudus (Taphozous), 348.
breviceps (Cogia), 572.
breviceps (Kogia), 572.
breviceps (Physeter), 572.
brevirostris (Orcella), 578.
brevirostris (Phocæna), 578.
brevitarsus (Rhinolophus), 279.
brodei (Sciurus), 383.
brookei (Ovis), 495.
brunnea (Cerivoula), 341.
brunneus (Macacus), 17.
brunneus (Mus), 406, 408.
brunneusculus (Mus), 406.
bubalina (Capricornis), 513.
bubalinus (Antilope), 513.
bubalinus (Nemorhædus) 513.
Bubalus, 483.
bubalus (Bos), 491.
bubalus, var. fulvus (Bos), 492.
Budorcas, 515.
baduga (Mus), 416.
Buffalo, 491.
buffelus (Bos), 491.
buffelus (Bubalus), 491.
burrhel (Ovis), 499.

Cachalot, 571.
cachhensis (Taphozous), 349.
cærulea (Crocidura), 236.
cærulescens (Crocidura), 236.
cærulescens (Sorex), 236.
cæruleus (Sorex), 236.
caffra (Felis), 86.
Ca'ing whales, 577.
Calictis, 119.
caligata (Felis), 86.
caliginosus (Vespertilio), 337.
Calogale, 119.
Camelus, 558.
cana (Vulpes), 150.
canadensis (Cervus), 535, 538.
cancrivora (Urva), 129.
caniceps (Pteromys), 365.
caniceps (Sciuropterus), 365.
caniceps (Sciurus), 380.
Canidæ, 134.
canigula (Mustela), 167.
canigula (Putorius), 167.
Canis, 135.
cantori (Taphozous), 348.
canus (Nycticejus), 315.
capensis (Delphinus), 588.
capensis (Sorex), 236.
Capra, 501.
Capricornis, 572.
Caprolagus, 448.
Caprovis, 493.
caracal (Felis), 88.
carbonarius (Macacus), 21.
carnatica (Vespertilio), 293.
Carnivora, 49.
Carponycteris, 265.
cashmerensis (Cervus), 535.
cashmirianus (Cervus), 535.
caspicus (Cervus), 538.
castaneus (Nycticejus), 320.
castaneus (Rhizomys), 438.
catalania (Tursiops), 581.
Cat-bear, 190.
cathia (Putorius), 169.
Catodon, 570.
catolynx (Felis), 86.
Cats, 55.
caucasica (Capra), 502.
caudata (Corsira), 230.
caudatior (Mus), 409.
caudatus (Arctomys), 390.
caudatus (Sorex), 230.
caudatus (Soriculus), 230.
Cavicornia, 482.
cavifrons (Bos), 484.
cavirostris (Ziphius), 573.
celidogaster (Felis), 76.
Cemas, 516.
cephalopterus (Presbytis), 34.
cephalopterus (Semnopithecus), 34.
Ceratorhinus, 476.
Cercopithecidæ, 10.
Cercopithecinæ, 10.
Cerivoula, 338.
cervicapra (Antilope), 521.
cervicapra (Capra), 521.
cervicolor (Mus), 416, 417.
Cervidæ, 530.
Cervinæ, 531.
Cervulus, 531.
Cervus, 534.
Cetacea, 564.
ceylanica (Crocidura), 236.
ceylanicus (Chrysæus), 144.
ceylanicus (Herpestes), 127.
ceylonicus (Sciurus), 374.
ceylonicus (Scotophilus), 312.
ceylonicus (Vesperugo), 312.
ceylonus (Mus), 406.
chanco (Canis), 135.
charltoni (Felis), 74.
chaus (Felis), 86.
chevrieri (Mus), 416.
Chevrotains, 554.
chickara (Antilope), 519.

CSL

[illegible]ckera (Tetraceros), 519.
Chimarrogale, 245.
chinensis (Felis), 78.
chinensis (Tupaia), 210.
Chiromeles, 353.
Chiropodomys, 403.
Chiroptera, 257.
chiropus (Mus), 413, 602.
chiru (Antilope), 524.
Chita, 91.
christii (Gazella), 526.
Chrysæus, 142.
chrysogaster (Galidictis), 158.
chrysogaster (Moschus), 552.
chrysogaster (Presbytes), 38.
chrysogaster (Semnopithecus), 38.
chrysonotus (Sciurus), 380.
chrysothrix (Sciuropterus), 364.
cineraceus (Hipposideros), 289.
cineraceus (Pteromys), 361.
cinerascens (Rhinolophus), 274.
cinerea (Cemas), 576.
cinerea (Lutra), 601.
cinereus (Eupetaurus), 359.
cinereus (Nycticebus), 45.
cinereus (Rhizomys), 439.
cinnamomeus (Mus), 409.
circumdatus (Vesperugo), 312.
Civets, 95.
civettina (Viverra), 98.
civettoides (Viverra), 96.
Cladobates, 208.
cœlophyllus (Rhinolophus), 272.
Cœlops, 290.
coffæus (Golunda), 427.
Cogia, 572.
collaris (Arctonyx), 178.
collaris (Erinaceus), 215.
collaris (Meles), 179.
communis (Barbastellus), 298.
concolor (Mus), 408.
concolor (Sciurus), 380.
coromandelianus (Scotophilus), 313.
coromandelicus (Vespertilio), 313.
coxingi (Mus), 412.
craspedotis (Lepus), 452.
crassicaudata(Manis),597.
crassipes (Mus), 406.
crassispinis (Hystrix), 445.
crassus (Taphozous), 350.
Cricetinæ, 428.
Cricetus, 436.
crispus (Nemorhædus), 573.
cristata, var. indica (Hystrix), 442.
cristatus (Presbytis), 39.
cristatus (Sus), 560.
Crocidura, 231.
crocuta (Hyæna), 131.
crossei (Ceratorhinus), 476.
crossei (Rhinoceros), 476.
crossii (Paradoxurus), 108.
cryptura (Talpa), 225.
cucullatus (Semnopithecus), 33.
cunicularis (Mus), 417.
Cuon, 142.
curvostylis (Cervulus), 532.
curzoniæ (Lagomys), 457, 458.
cuvieri (Gerbillus), 396.
Cuvierius, 566.
cycloceros (Ovis), 497.
cyclotis (Harpyiocephalus), 326.
cyclotis (Murina), 326.
Cynælurus, 90.
Cynoidea, 134.
cynomolgus (Macacus), 21.
Cynonycteris, 261.
Cynopterus, 262.
Cyon, 142.

daccaensis (Mus), 423.
darjeelingensis (Mus), 413.
darjelingensis (Plecotus), 298.
darjelingensis (Synotus), 298.
darjelingensis (Vespertilio), 336.
daubentoni (Verspetilio), 331.
dauricus (Lagomys), 459.
dauvergnei (Capra), 504.
davidianus (Putorius), 171.
dayanus (Lepus), 457.
dayi (Crocidura), 240, 602.
deccanensis (Cyon), 143, 601.
decumanoides(Mus), 408.
decumanus (Mus), 408.
Deer, 530.
deformis (Rhinolophus), 288.
delesserti (Sciurus), 385.
Delphinidæ, 573.
Delphinus, 586.
delphis (Delphinus), 587.
densirostris (Mesoplodon), 573.
derbyanus (Paradoxurus), 117.
Dermoptera, 248.
desertorum (Vespertilio), 333.
diadema (Hipposiderus), 283, 284.
diadema (Phyllorhina), 285.
diardi (Felis), 72.
dichrous (Arctomys), 391.
dimidiatus (Acomys), 426.
dimidiatus (Mus), 426.
dimorphe (Cervus), 538.
Dinops, 353.
Dipodidæ, 391.
discolor (Vesperugo), 305.
dobsoni (Vespertilio), 335, 602.
Dogs, Wild, 142.
Dolphin, 587.
dorcas (Gazella), 528.
doris (Delphinus), 588.
dormeri (Nycticejus), 319.
dormeri (Scotozous), 319.
dormeri (Vesperugo), 319.
dosul (Leopardus), 74.
dromedarius (Camelus), 558.
dubius (Mus), 413.
dubius (Paradoxurus), 108.
dugong (Halicore), 594.
dugung (Trichechus), 594.
dukhunensis (Cyon), 143.
dukhunensis (Rhinolophus), 287.
dumeticola (Mus), 402.

Duplicidentata, 447.
dussumieri (Delphinus), 588.
dussumieri (Sciurus), 384.
dussumieri (Semnopithecus), 33.
duvauceli (Cervus), 538.
duvauceli (Rucervus), 539.
dybowskii (Cervus), 538.
Dysopes, 353.

Echinosorex, 219.
edeni (Balænoptera), 568.
Edentata, 525.
edulis (Pteropus), 259.
edwardsi (Pteropus), 257.
edwardsii (Antilope), 515.
edwardsii (Nemorhedus), 515.
elaphoides (Cervus), 538.
elaphus (Cervus), 535.
eldi (Cervus), 541.
eldii (Panolia), 541.
electra (Lagenorhynchus), 580.
elegans (Nectogale), 247.
Elephant, 463.
Elephantidæ, 462.
Elephas, 462.
Eleutherura, 261.
elliotanus (Mus), 426.
ellioti (Golunda), 427.
ellioti (Herpestes), 126.
ellioti (Leopardus), 78.
ellioti (Lutra), 185, 601.
ellioti (Tupaia), 209.
Ellobius, 434.
elphinstonii (Sciurus), 371.
emarginatus (Nycticejus), 321.
emarginatus (Scotophilus), 321.
emarginatus (Vespertilio), 233.
Emballonura, 344.
Emballonuridæ, 343.
Emballonurinæ, 344.
entellus (Presbytis), 27.
entellus (Semnopithecus), 27.
Eonycteris, 266.
Equidæ, 468.
equina (Rusa), 543.
equinus (Cervus), 543.
equioides (Asinus), 470.
Equus, 468.
Erinaceidæ, 212.
Erinaceinæ, 213.
Erinaceus, 213.
Ermine, 165.
erminea (Mustela), 165.
erminea (Putorius), 165.
erythræa (Simia), 13.
erythræus (Sciurus), 377.
erythrogaster (Sciurus), 377.
erythrogenys (Rhizomys), 440.
erythronotus (Mus), 416.
erythrotis (Felis), 86.
erythrotis (Lagomys), 458.
erythrotis (Mus), 420.
erythrura (Gerbillus), 399.
etrusca (Crocidura), 241.
Eudelphinus, 586.
Eupetaurus, 359.
Euphysetes, 572.
europæa (Talpa), 224.
eurynome (Delphinus), 581.
euryspilus (Helarctos), 199.
eustephanus (Cervus), 538.
Eutheria, 2.
eversmanni (Putorius), 164.

falconeri (Ægoceros), 505.
falconeri (Capra), 505.
familiaris, var. sumatrensis (Canis), 147.
fasciatus (Paradoxurus), 109.
fasciculata (Atherura), 446.
feæ (Cervulus), 534.
feæ (Harpyiocephalus), 602.
Felidæ, 53.
Felis, 55.
femoralis (Semnopithecus), 42.
Feroculus, 231.
ferox (Simia), 16.
ferrilatus (Cynalopex), 155.
ferrilatus (Vulpes), 155.
ferruginea (Tupaia), 210.
ferrugineus (Herpestes), 123.
ferrugineus (Sciurus), 375.
ferrugineus (Sorex), 233.
ferrum-equinum (Rhinolophus), 278, 279.
fimbriatus (Sciuropterus), 366.
finlaysoni (Sciurus), 375.
finlaysonii (Paradoxurus), 108.
Fin-whales, 566.
Fissipedia, 50.
flaveolus (Nycticejus), 320.
flavescens (Mus), 406.
flavescens (Vulpes), 151, 153.
flavidens (Herpestes), 127.
flavigula (Martes), 158.
flavigula (Mustela), 158.
floweri (Rhinoceros), 475.
fluminalis (Orcella), 579.
Flying-Foxes, 255.
Flying-Lemurs, 248.
Flying-Squirrels, 360.
foina (Martes), 160.
foina (Mustela), 160.
formosa (Murina), 335.
formosus (Vespertilio), 335.
Foxes, 147.
frænatus (Delphinus), 588.
frederici (Herpestes), 123.
frithi (Cœlops), 291.
frontalis (Bos), 487.
frontalis (Cervus), 541.
frontalis (Gavæus), 487.
frontatus (Delphinus), 582.
frontatus (Steno), 582.
fulgens (Ælurus), 190.
fulgens (Rhinolophus), 289.
fuliginosa (Crocidura), 242.
fuliginosus (Scotophilus), 342.
fuliginosus (Sorex), 242.
fulva (Phyllorhina), 289.
fulvescens (Herpestes), 127.
fulvescens (Mus), 409.
fulvidiventris (Mus), 416.
fulvidus (Scotophilus), 307.
fulvidus (Taphozous), 348.
fulvo-cinerea (Crocidura), 236.
fulvus (Cricetus), 437.
fulvus (Hipposideros), 239.
fumigata (Crocidura), 243.

fumigatus (Sorex), 243.
fusca (Kerivoula), 340.
fuscatus (Tragulus), 557.
fuscicapillus (Ellobius), 435.
fuscicapillus (Sciuropterus), 368.
fuscicaudatus (Scaptonyx), 227.
fuscifrons (Gazella), 526.
fuscocapillus (Georychus), 435.
fuscocapillus (Myospalax), 435.
fuscocapillus (Pteromys), 368.
fuscus (Herpestes), 127.
fusiformis (Delphinus), 580.

gadamu (Delphinus), 583.
gadamu (Sotalia), 583.
Galeopithecidæ, 248.
Galeopithecus, 248.
Galerella, 119.
galerita (Phyllorhina), 287.
galeritus (Hipposiderus), 287.
gangetica (Platanista), 590.
gangeticus (Delphinus), 590.
garoensis (Rhinolophus), 277.
Gaur, 484.
gaurus (Bos), 484.
gaurus (Gavæus), 484.
Gavæus, 483.
gavæus (Bos), 487.
gayæus (Bos), 484.
Gayal, 487.
Gazella, 525.
Gazelles, 525.
gedrosianus (Ursus), 197.
geoffroyi (Nyctophilus), 299.
Gerbillinæ, 396.
gerbillinus (Mus), 414.
Gerbillus, 396.
germaini (Sciurus), 375.
ghoral (Kemas), 516.
Ghorkhar, 470.
Gibbons, 5.
giganteus (Mus), 425.
giganteus (Sciurus), 373.
giganteus (Sorex), 236.
Giraffidæ, 529.
gladiator (Delphinus), 576.
gladiator (Orca), 576.
gleadowi (Gerbillus), 400.
gleadowi (Mus), 420.
gliroides (Chiropodomys), 403.
gliroides (Mus), 403.
Glisores, 208.
Globicephalus, 577.
Goats, 501.
Golunda, 427.
golundi (Mus), 427.
goral (Antilope), 516.
goral (Cemas), 516.
goral (Nemorhedus), 516.
gordoni (Sciurus), 377.
gour (Bos), 484.
gracilicauda (Soriculus), 230.
gracilis (Loris), 47.
gracilis (Prionodon), 105.
gracilis (Stenops), 47.
Grampus, 576.
Gravedigger, 177.
grayi (Erinaceus), 215.
grayi (Paradoxurus), 112.
grayiformis (Cuon), 144.
grayii (Euphysetes), 572.
griffithii (Nesokia), 422.
griffithii (Sorex), 233.
griffithii (Vulpes), 151.
grisea (Cemas), 516.
griseimanus (Sciurus), 381.
griseus (Grampus), 578.
griseus (Harpyiocephalus), 325.
griseus (Herpestes), 123.
griseus (Lagomys), 458.
grotei (Acanthochœrus), 445.
grunniens (Bos), 490.
grunniens (Poëphagus), 490.
Guavera, 485.
guentheri (Microtus), 433.
guentheri (Trichys), 447.
guttata (Felis), 91.
gutturosa (Gazella), 528.
gwatkinsi (Martes), 158.
Gymnura, 219.
gymnura (Viverra), 220.
Gymnurinæ, 219.

Halicore, 593.
Hamsters, 436.
Hapalomys, 401.
hardwickei (Hemigale), 117.
hardwickei (Nesocia), 422, 423.
hardwickii (Cerivoula), 340.
hardwickii (Mus), 422.
hardwickii (Rhinopoma), 351.
Hares, 448.
harpia (Vespertilio), 325.
harpyia (Harpyiocephalus), 325.
Harpyiocephalus, 323.
hasselti (Vespertilio), 330.
hazenna (Antilope), 526.
heathii (Nycticejus), 320.
Hedgehogs, 213.
Helarctos, 193.
Helictis, 172.
hemachelanus (Arctomys), 389, 390.
Hemiechinus, 214.
hemionus (Asinus), 470.
hemippus (Equus), 470.
Hemitragus, 508.
hemprichi (Otonycteris), 300.
hermaphroditus (Paradoxurus), 106, 108.
Herpestes, 119.
Herpestinæ, 119.
herschelii (Felis), 78.
Hesperoptenus, 303.
heterocervus (Rusa), 543.
heterodon (Sorex), 234.
himalaica (Crocidura), 245.
himalaicus (Canis), 153.
himalayana (Capra), 503.
himalayanus (Arctomys), 388.
himalayanus (Felis), 76.
himalayica (Chimarrogale), 245.
himalayicus (Crossopus), 245.
hippelaphus (Cervus), 543.
hippelaphus (Rusa), 543.
Hippopotamidæ, 563.
Hippopotamus, 563.
Hipposiderinæ, 280.
Hipposiderus, 281.
hipposiderus (Rhinolophus), 277.
hippurus (Sciurus), 377.
Hircus, 501.

hirsutirostris (Hystrix), 442.
hirsutus (Mus), 127.
hirsutus (Paradoxurus), 106, 108.
hispidus (Caprolagus), 454.
hispidus (Lepus), 454.
hodgsoni (Arctomys), 389.
hodgsoni (Crocidura), 240.
hodgsoni (Hystrix), 444.
hodgsoni (Lagomys), 456.
hodgsoni (Mustela), 166, 167.
hodgsoni (Ovis), 494.
hodgsoni (Pantholops), 524.
hodgsoni (Sorex), 240.
hodgsonii (Antilope), 524.
hodgsonii (Kemas), 524.
hodgsonii (Vulpes), 148.
Hog-badger, 178.
Hog-deer, 549.
holosericeus (Sorex), 230.
Hominidæ, 4.
homochrous (Plecotus), 297.
homourus (Mus), 413.
homoürus (Sorex), 230.
hoolock (Hylobates), 5, 601.
horeites (Mus), 406.
horsfieldi (Crocidura), 242.
horsfieldi (Megaderma), 294.
horsfieldi (Sorex), 242.
horsfieldii (Leopardus), 78.
horsfieldii (Mustela), 116.
horsfieldii (Pteromys), 367.
horsfieldii (Sciuropterus), 367.
humei (Mus), 423.
humeralis (Mustela), 166.
hurrianæ (Gerbillus), 398.
huttoni (Felis), 85.
huttoni (Nesokia), 422.
huttonii (Harpyiocephalus), 327.
Hyæna, 131.
Hyænidæ, 131.
Hyelaphus, 534.
Hylobates, 5.
hylocrius (Capra), 511.
hylocrius (Hemitragus), 511.
hylocrius (Kemas), 511.
Hylogale, 208.
Hylomys, 219, 602.
hyperythrus (Sciurus), 382.
hypoleucos (Presbytis), 33.
hypoleucus (Semnopithecus), 33.
hypsibius (Lepus), 453.
Hypudæus, 429.
Hyracoidea, 461.
Hystricidæ, 441.
Hystricomorpha, 358.
Hystrix, 441.

Ibex, 501.
ibex (Capra), 503.
Ichneumon, 119.
Ictides, 117.
imbricatus (Vespertilio), 313.
inauritus (Ursitaxus), 176.
inconspicua (Felis), 85.
indi (Platanista), 590.
indica (Alactaga), 392.
indica (Arvicola), 422.
indica (Balænoptera), 567.
indica (Lutra), 182.
indica (Megaptera), 568.
indica (Mellivora), 176.
indica (Meminna), 555.
indica (Nesokia), 422, 423.
indica (Spalacomys), 422.
indica (Viverra), 100.
indicus (Asinus), 470.
indicus (Bos), 483.
indicus (Elephas), 463.
indicus (Funambulus), 383.
indicus (Gerbillus), 396, 398.
indicus (Globicephalus), 577.
indicus (Halicore), 594.
indicus (Mus), 396, 406, 422, 423, 425.
indicus (Oxygoüs), 140.
indicus (Pholidotus), 597.
indicus (Rhinoceros), 472.
indicus (Sacalius), 140.
indicus (Sciurus), 371.
indicus (Sorex), 236.
indicus (Sus), 560.
indicus (Tapirus), 478.
indicus (Ursus), 176.
indicus (Vesperugo), 312.
indigitata (Lutra), 187.
inermis (Rhinoceros), 475.
infralineatus (Mus), 406.
inornatus (Pteromys), 363.
inornatus (Ursus), 201.
Insectivora, 206.
Insectivora vera, 207.
insignis (Rhinolophus), 288.
intermedius (Ellobius), 435.
Inuus, 11.
iodes (Tetracerus), 520.
irbis (Felis), 71.
irus (Macacus), 21.
isabellina (Felis), 89.
isabellinus (Cricetus), 437.
isabellinus (Nycticejus), 317.
isabellinus (Ursus), 194.
isonyx (Arctonyx), 179.

Jackal, 140.
jacquemontii (Felis), 86.
Jald-hasti, 563.
jarai (Cervus), 543.
jaraya (Rusa), 543.
javanensis (Felis), 78.
javanica (Hystrix), 445.
javanica (Manis), 599.
javanica (Nycteris), 295.
javanica (Tupaia), 212.
javanicus (Canis), 147.
javanicus (Herpestes), 130.
javanicus (Moschus), 556, 557.
javanicus (Nycticebus), 46.
javanicus (Rhinoceros), 474.
javanicus (Tragulus), 556, 557.
javensis (Felis), 78.
jemlahica (Capra), 509.
jemlaicus (Hemitragus), 509.
Jerboas, 391.
jerdoni (Capra), 505.
jerdoni (Erinaceus), 216.

jerdoni (Felis), 78.
jerdoni (Leggada), 411.
jerdoni (Mus), 411.
jerdoni (Paradoxurus), 111.
jerdonii (Herpestes), 126.
jharal (Capra), 509.
jharal (Hemitragus), 509.
johni (Semnopithecus), 33.
johnii (Presbytis), 33.
johorensis (Nyctinomus), 355.
joongshaiensis (Lepus), 451.
jubata (Felis), 91.
jubatus (Cynælurus), 91.
jubatus (Presbytis), 33.
jubatus (Semnopithecus), 33.

kachhensis (Taphozous), 349.
kakhyenensis (Mus), 413.
kanchil (Moschus), 556.
kanchil (Tragulus), 556.
kandianus (Mus), 406.
kandianus (Sorex), 233.
karelini (Ovis), 496.
Kashmir Stag, 535.
kathia (Mustela), 169.
kelaarti (Crocidura), 244.
kelaarti (Sciurus), 383.
kelaarti (Semnopithecus), 34.
kelaarti (Sorex), 244.
kelaartii (Pteropus), 257.
Kemas, 516.
kemas (Antilope), 524.
kephalopterus (Cercopithecus), 34.
keraudrenii (Sciurus), 375.
Kerivoula, 338.
Kiang, 470.
kiang (Equus), 470.
Killer, 576.
kingiana (Crocidura), 242.
Kogia, 572.
kok (Mus), 423.
kok (Nesokia), 423.
kokree (Canis), 148.
Kol bhálú, 142.
kuhli (Nycticejus), 320.
kuhli (Vesperugo), 315.
kuhlii (Scotophilus), 320.
kurrachiensis (Neomeris), 575.
kutas (Felis), 86.

labiata (Vesperugo), 308.
labiatus (Ursus), 201.
ladacensis (Lagomys), 458.
Lagenorhynchus, 579.
Lagomyidæ, 455.
Lagomys, 455.
Lama, 558.
laneus (Cynælurus), 90.
laniger (Lupus), 135.
laniger (Paradoxurus), 114.
lankadiva (Hipposiderus), 283, 285.
lanuginosus (Mus), 419.
lar (Hylobates), 7.
larvata (Paradoxurus), 114.
larvata (Phyllorhina), 288.
larvatus (Hipposiderus), 288.
larvatus (Putorius), 163.
larvatus (Rhinolophus), 273.
lasiotis (Ceratorhinus), 476.
lasiotis (Rhinoceros), 476.
lasiurus (Platacanthomys), 394.
lasyura (Noctilinea), 325.
layardi (Sciuropterus), 368.
layardi (Sciurus), 385.
leachii (Pteromys), 367.
Leggada, 419.
leisleri (Scotophilus), 309.
leisleri (Vesperugo), 309.
Lemuridæ, 43.
Lemuroidea, 43.
Lemurs, 43.
Lemurs, Flying, 248.
lentiginosa (Sotalia), 584.
lentiginosus (Delphinus), 584.
lentiginosus (Steno), 584.
leo (Felis), 56.
leoninus (Inuus), 18.
leoninus (Macacus), 18.
Leopard, 67.
Leopard, hunting, 91.
leopardus (Felis), 67.
lepida (Leggada), 416.
lepidus (Mus), 416.
lepidus (Pipistrellus), 315.
lepidus (Rhinolophus), 277.
lepidus (Sciuropterus), 368.
Leporidæ, 447.
leptonyx (Aonyx), 187.
leptonyx (Lutra), 187, 601.
leptophylla (Phyllorhina), 284.
leptophyllum (Hipposiderus), 284.
leptura (Manis), 599.
Lepus, 448.
leschenaultii (Cervus), 543.
leschenaultii (Pteropus), 261.
leucocephalus (Pteropus), 257.
leucodon (Sorex), 243.
leucogaster (Harpyiocephalus), 327.
leucogaster (Moschus), 552.
leucogaster (Murina), 327.
leucogenys (Crocidura), 239.
leucogenys (Hylobates), 9.
leucolachnæa (Martes), 160.
leucolæmus (Meles), 180.
leucoprymnus (Cercopithecus), 34.
leucops (Sorex), 230.
leucopus (Vulpes), 151.
leucotis (Arctogale), 115.
leucotis (Paradoxurus), 115.
leucotis (Vesperugo), 315.
leucura (Hystrix), 442.
leucura (Manis), 599.
leucura (Parascaptor), 226.
leucura (Talpa), 226.
leucura (Taxidea), 180.
leucurus (Pangolinus), 599.
leucurus (Phaiomys), 432.
Linsang, 102.
Lion, 56.
lobatus (Scotophilus), 315.
lobipes (Vespertilio), 337.

CSL

locria (Sciurus), 376.
locroides (Sciurus), 381.
lokriah (Sciurus), 376.
lokroides (Sciurus), 381.
longicauda (Hystrix), 444, 445.
longicaudatus (Hapalomys), 401.
longimanus (Taphozous), 348.
longipes (Vespertilio), 331.
longirostris (Delphinus), 588, 589.
Loris, 47.
luctus (Rhinolophus), 270.
luehdorfi (Cervus), 538.
Lupus, 135.
lupus (Canis), 135, 137.
luteus (Nycticejus), 320.
Lutra, 181.
Lutrinæ, 181.
lynx (Felis), 89.
lyra (Megaderma), 293.

Macacus, 11.
maccarthiæ (Cynictis), 127.
maccarthiæ (Herpestes), 127.
maccarthiæ (Onychogale), 127.
macclellandi (Sciurus), 386.
macclellandi, var. swinhoei (Sciurus), 386.
macleayi (Euphysetes), 572.
macracanthus (Erinaceus), 217.
macrocelis (Felis), 72.
macroceloides (Felis), 72.
macrocephalus (Catodon), 571.
macrocephalus (Physeter), 571.
macrocerus (Bos), 492.
macrodus (Lutra), 601.
Macroglossus, 265.
macropus (Crocidura), 237.
macropus (Feroculus), 237.
macropus (Mus), 426.
macropus (Sorex), 237.
macropus (Vespertilio), 331.
macrotis (Crocidura), 241.
macrotis (Lagomys), 457.
macrotis (Rhinolophus), 276.
macrotus (Lepus), 450.
macroura (Hystrix), 446.
macrura (Atherura), 446.
macrura (Talpa), 224.
macruroides (Sciurus), 373.
macrurus (Sciurus), 374.
macrurus (Sorex), 231.
macrurus (Soriculus), 231.
maculata (Axis), 547.
maculiventer (Delphinus), 582, 585.
maculiventer (Steno), 585.
maculosus (Prionodon), 104.
maderaspatanus (Scotophilus), 310.
magnificus (Pteromys), 363, 364.
major (Axis), 547.
malabarica (Hystrix), 442.
malabaricus (Mus), 425.
malabaricus (Sciurus), 371.
malaccensis (Herpestes), 123.
malaccensis (Viverra), 100.
malaccensis (Viverricula), 100.
malayanus (Delphinus), 588.
malayanus (Helarctos), 199.
malayanus (Prodelphinus), 588.
malayanus (Tapirus), 478.
malayanus (Ursus), 199.
Manatidæ, 591.
mandarinus (Microtus), 433.
manei (Mus), 413.
Mangusta, 119.
Manidæ, 595.
Manis, 595.
mantchuricus (Cervus), 538.
manul (Felis), 83.
maral (Cervus), 538.
marginatus (Cynopterus), 263.
marginatus, var. andamanensis (Cynopterus), 264.
Markhor, 505.
marmorata (Felis), 74.
Marmots, 388.
Martens, 158.
Martes, 157.
martes (Mustela), 161.
masoni (Phyllorhina), 285.
maurus (Macacus), 18.
maurus (Vesperugo), 310.
maximus (Elephas), 463.
maximus (Sciurus), 371.
media (Crocidura), 236.
medius (Pteropus), 257.
megaceros (Capra), 505.
megaceros (Hircus), 505.
Megachiroptera, 255.
Megaderma, 292.
megalopus (Vespertilio), 332.
megalotis (Erinaceus), 216.
Megaptera, 568.
megaspila (Viverra), 99.
melanodon (Sorex), 241.
melanogaster (Arvicola), 434.
melanogaster (Canis), 154.
melanogaster (Microtus), 434.
melanoleucus (Æluropus), 205.
melanopogon (Taphozous), 347.
melanopterus (Pteromys), 365.
melanostoma (Lagomys), 458.
melanotus (Papio), 17.
melanotus (Pteropus), 260.
melanurus (Viverra), 96.
melas (Cervus), 532.
melas (Delphinus), 575.
melas (Felis), 69.
Melinæ, 172.
Mellivora, 175.
Melogale, 172.
meltada (Golunda), 419.
Melursus, 200.
Meminna, 554.
meminna (Moschus), 555.
meminna (Tragulus), 555.
Meriones, 396.
Mesobema, 119.

mettada (Mus), 419.
Mice, 405.
Microchiroptera, 267.
micronyx (Sorex), 240.
microphyllum (Rhinopoma), 351.
micropus (Erinaceus), 218.
micropus (Phyllorhina), 290.
micropus (Vesperugo), 313.
Microtus, 429.
micrura (Talpa), 225.
milne-edwardsii (Capricornis), 515.
minima (Carponycteris), 265.
minimus (Macroglossus), 265.
Miniopterus, 341.
minor (Axis), 547.
minor (Rhinolophus), 276.
minor (Rhizomys), 438.
minuta (Felis), 78.
minutus (Sorex), 234.
Mithan, 487.
mitratus (Rhinolophus), 273.
molagan (Delphinapterus), 575.
Mole-rats, 421.
Moles, 223.
Molossinæ, 352.
Monkeys, 10, 25.
montana (Crocidura), 234.
montana (Ovis), 497.
montanus (Paradoxurus), 111.
montanus (Sorex), 233.
montanus (Vulpes), 153.
monticola (Lutra), 185.
monticolus (Herpestes), 126.
moormensis (Felis), 75.
mops (Nyctinomus), 355.
mordax (Vesperugo), 310.
morungensis (Mus), 423.
moschata (Helictis), 175.
moschatus (Cervulus), 532.
moschiferus (Moschus), 552.
Moschinæ, 551.
Moschus, 551.
mouhoti (Sciurus), 387.
moupinensis (Putorius), 171.
moupinensis (Vespertilio), 337.
Mouse Deer, 555.
Mouse-Hares, 455.
muelleri (Hystrix), 445.
mungo (Herpestes), 123.
Mungooses, 119.
Mungos, 119.
mungos (Mangusta), 123.
muntjac (Cervulus), 532.
Muntjacus, 531.
muntjacus (Stylocerus), 532.
muntjak (Cervus), 532.
muntjak (Styloceros), 532.
muricola (Vespertilio), 337.
Muridæ, 393.
Murina, 323.
murina (Crocidura), 233.
Murinæ, 400.
murinoides (Vespertilio), 335.
murinus (Dysopes), 354.
murinus (Hipposideros), 289.
murinus (Myotis), 334.
murinus (Sorex), 233, 236.
murinus (Vespertilio), 334.
Mus, 404.
musanga (Paradoxurus), 106, 108.
musangoides (Paradoxurus), 108.
muscatensis (Gazella), 528.
musculus (Balænoptera), 567.
musculus (Mus), 413.
Musk-deer, 552.
Mustela, 157, 162.
Mustelidæ, 156.
Mustelinæ, 157.
myiodes (Sorex), 243.
Myiomorpha, 357.
Myospalax, 434.
myosurus (Sorex), 233, 236.
myothrix (Mus), 427.
Myotis, 300, 328.
mystacinus (Vespertilio), 336.
Mystacocœti, 565.
mysticetus (Balænoptera), 566.

nahoor (Ovis), 499.
nahoor (Pseudoïs), 499.
nahura (Ovis), 499.
nair (Lutra), 182, 185.
nanus (Gerbillus), 399.
napu (Moschus), 557.
napu (Tragulus), 557.
narayanus (Cervus), 538.
nasalis (Rhinoceros), 475.
nasutus (Vesperugo), 304.
nayaur (Ovis), 494, 499.
nebulosa (Felis), 72.
Nectogale, 246.
nemestrinus (Inuus), 20.
nemestrinus (Macacus), 20.
nemoralis (Mus), 406.
Nemorhædus, 512, 516.
nemorivaga (Nesocia), 426.
nemorivagus (Mus), 426.
nemorivagus (Sorex), 233.
Neodon, 429.
Neomeris, 574.
nepalensis (Barangia), 186, 601.
nepalensis (Rusa), 543.
Nesocia, 421.
Nesokia, 421.
newera (Golunda), 427.
newera ellia (Corsira), 237.
nicobarensis (Hipposiderus), 286.
nicobarensis (Phyllorhina), 286.
nicobarica (Tupaia), 212.
nicobaricus (Cladobates), 212.
nicobaricus (Pteropus), 260.
niger (Canis), 135.
niger (Ceratorhinus), 476.
niger (Cervus), 543.
niger (Paradoxurus), 106.
niger (Sorex), 233.
nigrescens (Corsira), 229.
nigrescens (Felis), 75.
nigrescens (Soriculus), 229.
nigricollis (Lepus), 449.
nigrifrons (Paradoxurus), 108.
nigripectus (Felis), 83.
nilagiricus (Mus), 402.
Nilgai, 517.
nilgirica (Crocidura), 241.
nilssoni (Vesperugo), 305.
nipalensis (Felis), 78.
nipalensis (Gulo), 173.
nipalensis (Helictis), 173, 174.
nipalensis (Herpestes), 121.

GL

nipalensis (Lagomys), 456.
nipalensis (Musculus), 413.
nipalensis (Paradoxurus), 112.
nipalensis (Vespertilio), 333.
nipalensis (Vulpes), 153.
nitidofulva (Crocidura), 241.
nitidulus (Mus), 415.
nitidus (Mus), 406.
nitidus (Pteromys), 365.
nitscheri (Lepus), 454.
niveiventer (Mus), 412.
nivicolus (Nycticejus), 322.
nobilis (Hipposideros), 285.
nobilis (Sciuropterus), 364.
noctula (Vesperugo), 308.
Noctulinia, 300
nudipalpebra (Cervus), 346.
nudipes (Putorius), 171.
nudipes (Sorex), 241.
nudiventris (Erinaceus), 218.
nudiventris, subsp. kachhensis (Taphozous), 349.
Nycteridæ, 292.
Nycteris, 295.
Nycticebus, 44.
Nycticejus, 318.
Nyctinomus, 353.
Nyctocleptes, 438.
Nyctophilus geoffroyi, 299.
Nyctophilus timoriensis, 299.
nyula (Mangusta), 123.

obscurum (Lagenorhynchus), 580.
obscurus (Arctonyx), 180.
obscurus (Delphinus), 580.
obscurus (Presbytis), 41.
obscurus (Prodelphinus), 580.
obscurus (Semnopithecus), 41.
ochraceus (Ailurus), 190.
ocreatus (Macacus), 18.
octomammis (Mus), 411.
Odontocœti, 569.
ogilbii (Felis), 78.
oinops (Macacus), 13.
oiostolus (Lepus), 452.
oleracea (Vandeleuria), 402.
oleraceus (Mus), 402.
oligurus (Sorex), 230.
onager (Asinus), 470.
onager (Equus), 470.
Onychogale, 119.
oral (Pteromys), 361.
Orca, 576.
orca (Delphinus), 576.
Orcella, 578.
orientalis (Gulo), 173.
orientalis (Helictis), 173, 174.
orientalis (Viverra), 96.
ornata (Felis), 84.
ornatus (Nycticejus), 322.
ornatus (Scotophilus), 322.
oryzus (Axis), 549.
Osmetectis, 119.
Otonycteris, 299.
Otters, 181.
Ounce, 71.
Ovis, 493.
Oxygous, 135.

paccerois (Tetracerus), 520.
pachyomus (Scotophilus), 303.
pachyotis (Vesperugo), 307.
pachypus (Vesperugo), 307.
Pachysoma, 262.
Pachyura, 231.
Paguma, 105, 114.
pallasii (Platyschista), 106.
pallida (Kerivoula), 335.
pallida (Viverra), 100.
pallidiventris (Vespertilio), 314, 333.
pallidus (Herpestes), 123.
pallidus (Nycticejus), 322.
pallidus (Scotophilus), 322.
pallipes (Canis), 137.
pallipes (Herpestes), 121.
pallipes (Lepus), 452, 453.
palmarum (Mus), 406.
palmarum (Sciurus), 383.
Palm-Civets, 105.
Pangolins, 595.
Panolia, 534.
Panther, 67.
Pantholops, 524.
papillosa (Cerivoula), 341.
Paradoxurus, 105.
Parascaptor, 223.
pardicolor (Prionodon), 103.
pardochrous (Felis), 78.
pardus (Felis), 67.
parvipes (Myotis), 313.
Pazen, 503.
pealiana (Crocidura), 234.
pearsoni (Rhinolophus), 273.
pearsoni (Sciuropterus), 369.
pearsonii (Lasiurus), 325.
Pecora, 481.
peguana (Tupaia), 210.
peguensis (Hylomys), 222.
peguensis (Lepus), 451.
peguensis (Mus), 403.
pelandoc (Tragulus), 557.
Pelomys, 427.
pelops (Inuus), 15.
pelops (Macacus), 15.
pembertoni (Sciurus), 386.
penicillatus (Chiropodomys), 403.
penicillatus (Sciurus), 383.
pennantii (Axis), 543.
pennantii (Paradoxurus), 106.
pentadactyla (Manis), 597.
perchal (Mus), 425.
Perissodactyla, 467.
perniger (Delphinus), 583.
perniger (Rhinolophus), 270.
perniger (Steno), 583.
perniger (Tursiops), 583.
pernyi (Sciurus), 377.
perrotteti (Crocidura), 241.
perrotteti (Sorex), 241.
persica (Vulpes), 152.
persicus (Herpestes), 121.
persicus (Triænops), 280.
personata (Helictis), 174.
personata (Melogale), 174.
petaurista (Pteromys), 361, 365.
petersi (Rhinolophus), 275.
phæus (Cricetus), 436.

Phaiomys, 429.
phayrei (Presbytis), 39.
phayrei (Sciuropterus), 368.
phayrei (Sciurus), 379.
phayrei (Semnopithecus), 39.
Pheál, 142.
philippensis (Pteromys), 361.
Phiou, 142.
Phnew, 142.
Phocæna, 574.
phocænoides (Delphinapterus), 574.
phocænoides (Neomeris), 574.
phocænoides (Phocæna), 574.
Phyllorhina, 281.
Physalus, 566.
Physeter, 570.
Physeteridæ, 570.
Physeterinæ, 570.
piceus (Sciurus), 377.
picta (Antilope), 517.
picta (Cerivoula), 339.
picta (Portax), 518.
picticaudata (Gazella), 529.
picticaudata (Procapra), 529.
pictus (Erinaceus), 217.
Pigs, 559.
pileatus (Macacus), 24.
pileatus (Presbytis), 37.
pileatus (Semnopithecus), 37.
pilorides (Sorex), 236.
Pilot whales, 577.
pipistrellus (Myotis), 314.
pipistrellus (Vesperugo), 314.
piscator (Ursus), 205.
planiceps (Felis), 83.
Platacanthomyinæ, 394.
Platacanthomys, 394.
Platanista, 589.
Platanistidæ, 589.
platycephalus (Chimarrogale), 246.
platyceros (Panolia), 541.
Platyschista, 105.
platythrix (Leggada), 418.
platythrix (Mus), 418.
Plecotus, 297.
Plesiometacarpi, 531.
plicatus (Nyctinomus), 354.
plumbea (Sotalia), 583.
plumbeus (Delphinus), 583.
plumbeus (Steno), 583.
plurimammis (Mus), 423.
Poëphagus, 483.
poëphagus (Bison), 490.
poëphagus (Bos), 490.
Polecats, 162.
poli (Ovis), 496.
polyodon (Asinus), 470.
pomeegra (Delphinus), 587.
porcinus (Axis), 549.
porcinus (Cervus), 549.
porcinus (Hyelaphus), 549.
Porcula, 559.
Porcupines, 441.
Porpoise, Indian, 574.
Portax, 517.
Potamochœrus, 560.
potenziani (Semnopithecus), 38.
povensis (Mus), 402.
prehensilis (Paradoxurus), 108, 115.
Presbytis, 25.
priamus (Presbytis), 31.
priamus (Semnopithecus), 31.
primævus (Canis), 143.
primævus (Cuon), 144, 147.
Primates, 3.
Prionodon, 102.
problematicus (Macacus), 15.
Proboscidea, 462.
Procapra, 525.
Procervus, 534.
Prochilus, 200.
proclivus (Nemorhædus), 513.
Procyonidæ, 189.
Prodelphinus, 586.
providens (Mus), 423.
Prox, 531.
pruinosus (Rhizomys), 439.
pruinosus (Ursus), 134.
Pseudocervus, 534.
Pseudoïs, 493.
Pteromys, 360.
Pteropodidæ, 255.
Pteropus, 255.
pulcher (Taphozous), 360.
punctatissimus (Macroxus), 377.
punctatus (Pteromys), 365.
purpureus (Sciurus), 371.
pusillus (Miniopterus), 342.
pusillus (Rhinolophus), 277.
pusillus (Vulpes), 151.
putorinus (Putorius), 164.
Putorius, 162.
pyctorhis (Mus), 422.
pygerythrus (Sciurus), 379.
pygmæoides (Crocidura), 240.
pygmæus (Mus), 420.
pygmæus (Sorex), 240.
Pygmura, 244.
pyrivorus (Pteropus), 261.

quadricornis (Antilope), 519.
quadricornis (Tetracerus), 519.
quadrimammis (Capra), 509.
quadrimammis (Hemitragus), 509.
quadriscriptus (Paradoxurus), 109.
quinquelineatus (Paradoxurus), 108.
quinquestriatus (Sciurus), 378.

Racoons, 189.
radiatus (Macacus), 23.
rafflesi (Gymnura), 220.
rama (Mus), 413.
rammanika (Rhinolophus), 274.
rasse (Viverra), 100.
ratel (Mellivora), 176.
Ratels, 175.
Rats, 404.
rattoides (Mus), 406.
rattus (Mus), 406.
rattus rufescens (Mus), 406.
ratwa (Cervus), 532.
reevesi (Cervulus), 533.
retusa (Crocidura), 242.
rheso-similis (Macacus), 15.
rhesus (Inuus), 13.
rhesus (Macacus), 13.
Rhinoceros, 471.
Rhinocerotidæ, 471.
Rhinolophidæ, 267.

Rhinolophinæ, 268.
Rhinolophus, 268.
Rhinopoma, 350.
Rhizomys, 438.
Rib-faced Deer, 532.
risia (Damalis), 517.
robustus (Arctomys), 391.
robustulus (Mus), 406.
Rodentia, 356.
roseiventris (Delphinus), 538.
rostrata (Balænoptera), 566.
rostratus (Delphinorhynchus), 582.
rostratus (Delphinus), 582.
rostratus (Hyperoodon), 573.
rostratus (Steno), 582.
rouxii (Rhinolophus), 274.
roylei (Arvicola), 430.
roylei (Lagomys), 456.
roylei (Microtus), 430.
rubicunda (Crocidura), 239.
rubida (Capricornis), 514.
rubidus (Paradoxurus), 114.
rubidus (Rhinolophus), 274.
rubiginosa (Felis), 81.
rubiginosus (Crossarchus), 126.
rubiginosus (Herpestes), 126.
rubricosa (Crocidura), 242.
Rucervus, 534.
rufescens (Canis), 148.
rufescens (Lagomys), 458.
rufescens (Macacus), 18.
rufescens (Mus), 406.
ruficaudatus (Lepus), 450.
rufigenis (Sciurus), 376.
Rusa, 534.
russulus (Sorex), 243.
rutilans (Canis), 147.
rutilans (Cuon), 144.
rutilans (Cyon), 147.
rutilus (Lagomys), 458.

Saccalius, 135.
saccolæmus (Taphozous), 350.
saccolaimus (Taphozous), 350.
sagitta (Sciuropterus), 367.
sakeen (Capra), 503.
sakin (Ibex), 503.
salvania (Porcula), 563.
salvanius (Sus), 563.
Sámbar, 543.
sarmatica (Mustela), 164.
sarmaticus (Putorius), 164.
saturatior (Sorex), 233.
saturatus (Moschus), 552.
savii (Vesperugo), 311.
scherzeri (Cynopterus), 264.
schistacea (Megaderma), 293.
schistaceus (Presbytis), 30.
schistaceus (Semnopithecus), 30.
schlegeli (Balænoptera), 567.
schomburgki (Cervus), 540.
schreibersi (Miniopterus), 342.
Scirtetes, 391.
Sciuridæ, 358.
Sciurinæ, 359.
Sciuromorpha, 357.
Sciuropterus, 366.
Sciurus, 369.
Scotophilus, 300, 318.
scrofa (Sus), 560.
scullyi (Nesocia), 423.
sechellensis (Dioplodon), 573.
semicaudata (Emballonura), 345.
semitorquatus (Herpestes), 130.
Semnopithecinæ, 25.
Semnopithecus, 25.
senex (Cercopithecus), 35.
senex (Sciuropterus), 365.
senex (Semnopithecus), 35.
serotinus (Scotophilus), 303.
serotinus (Vesperugo), 303.
Serow, 513.
serpentarius (Sorex), 233.
servalina (Felis), 84.
setifer (Mus), 426.
Shá, 497.
shawiana (Felis), 85.
Sheep, Wild, 493.
Shrews, 227.
Siamang, 9.
siamensis (Semnopithecus), 41, 42.
sibbaldi (Balænoptera), 567.
Sibbaldius, 566.
sibirica (Capra), 503.
sibirica (Ibex), 503.
sibirica (Mustela), 172.
sifanicus (Moschus), 552.
sika (Cervus), 538.
sikimensis (Microtus), 433.
sikimensis (Neodon), 433.
sikkimensis (Sorex), 229.
silenus (Inuus), 16.
silenus (Macacus), 16.
siligorensis (Vespertilio), 336.
Simiidæ, 4.
similis (Macroxus), 381.
Simplicidentata, 357.
simung (Lutra), 185.
simus (Physeter), 572.
sindensis (Crocidura), 236.
sinensis (Lepus), 451.
sinensis (Rhizomys), 440.
sinensis (Sotalia), 585.
sinicus (Macacus), 23, 24.
Sirenia, 591.
skyn (Ægoceros), 503.
sladeni (Mus), 406.
sladeni (Sciurus), 377.
Sloth-bear, 201.
smithii (Calictis), 126.
smithi (Herpestes), 126.
Snow Leopard, 71.
soccatus (Sorex), 233.
sondaicus (Bos), 489.
sondaicus (Gavæus), 489.
sondaicus (Rhinoceros), 474.
songarus (Cricetus), 431.
sonneratii (Sorex), 236.
Soricidæ, 227.
soricipes (Uropsilus), 227.
Soriculus, 228.
Sotalia, 582.
spadiceus (Sciuropterus), 368.
Spalacidæ, 437.
Spalacomys, 421.
spasma (Megaderma), 294.
spatangus (Erinaceus), 215.
speciosus (Inuus), 17.
spectrum (Megaderma), 293.

spelæa (Eonycteris), 266.
speoris (Hipposiderus), 287.
speoris (Phyllorhina), 287.
Spermophilus, 391.
Sperm-whale, 571.
spinulosa (Leggada), 418.
spirocerus (Bos), 492.
Squamata, 595.
squamipes (Anurosorex), 245.
Squirrels, 369.
Stag, Kashmir, 535.
Steno, 582.
stenocephalus (Rhinoceros), 472.
Stenops, 44.
Stoat, 165.
stoliczkana (Crocidura), 238.
stoliczkana (Mustela), 171.
stoliczkana (Putorius), 171.
stoliczkanus (Arvicola), 430.
stoliczkanus (Hipposiderus), 290.
stoliczkanus (Microtus), 430.
stracheyi (Arvicola), 431.
stracheyi (Microtus), 431.
striata (Hyæna), 132.
strictus (Paradoxurus), 109.
strigidorsa (Mustela), 170.
strigidorsus (Putorius), 170.
strophiatus (Mus), 417.
Stylocerus, 531.
subbadius (Rhinolophus), 277, 289, 290.
subcristata (Hystrix), 445.
subflaviventris (Sciurus), 376.
subfulva (Crocidura), 241.
subgutturosa (Antilope), 528.
subgutturosa (Gazella), 528.
subhemachalana (Mustela), 166.
subhemachalanus (Putorius), 166.
subhemachalus (Bibos), 484.
sublimis (Mus), 415.
sublineatus (Sciurus), 385.
sub-4-cornutus (Antilope), 519.
subquadricornutus (Tetracerus), 520.
Subungulata, 462.
Suidæ, 559.
suilla (Gymnura), 221, 602.
suilla (Murina), 326.
suillus (Harpyiocephalus), 328.
suillus (Hylomys), 221, 602.
Suina, 559.
sumatrana (Felis), 78.
sumatrana (Lutra), 187.
sumatranus (Ceratorhinus), 476.
sumatranus (Elephas), 463, 602.
sumatranus (Rhinoceros), 476.
sumatrensis (Antilope), 514.
sumatrensis (Capricornis), 514.
sumatrensis (Ceratorhinus), 476.
sumatrensis (Nemorhædus), 514.
sumatrensis (Rhinoceros), 476.
sumatrensis (Rhizomys), 439.
Sus, 559.
Swamp-deer, 540.
swinhoei (Gerbillus), 400.
swinhoei (Nemorhædus), 513.
sylhetanus (Bos), 487.
sylvaticus (Mus), 416.
Syncerus, 483.
syndactylus (Hylobates), 9.
Synotus, 298.
syriacus (Ursus), 205.

tabernaculi (Halicore), 593.
Tæniogale, 119.
Tahr, 509.
Takin, 515.
Talpa, 223.
Talpidæ, 222.
talpinus (Ellobius), 435.
tamulicus (Cervulus), 532.
tana (Tupaia), 212.
tangalunga (Viverra), 99.
Taphozous, 345.
Tapir, 478.
Tapiridæ, 478.
Tapirus, 478.
taraiyensis (Lutra), 182, 185.
tarayensis (Mus), 423.
tardigradus (Nycticebus), 44.
taurus (Bos), 483.
taxicolor (Budorcas), 515.
taxoides (Arctonyx), 180.
taxus (Meles), 181.
Tehr, 509.
Telemetacarpi, 531.
temmincki (Felis), 75.
temmincki (Nycticejus), 320.
temminckii (Galeopithecus), 249.
temminckii (Scotophilus), 320.
temon (Mustela), 168.
templetoni (Hipposiderus), 287.
tenasserimensis (Felis), 78.
tennantii (Sciurus), 374.
tenuis (Nyctinomus), 354.
terricolor (Mus), 416.
Tetracerus, 519.
Thameng, 541.
thar (Antilope), 513.
thar (Nemorhædus), 513.
theobaldi (Mus), 414.
theobaldi (Myotis), 331.
theobaldi (Taphozous), 348.
thersites (Presbytis), 34.
thibetanus (Ursus), 197.
thricolis (Arvicola), 433.
thysanurus (Herpestes), 126.
tibetanus (Arctomys), 388, 389.
tibetanus (Helarctos), 197.
tibetanus (Lagomys), 456.
tibetanus (Lepus), 452.
tibetanus (Macacus), 18.
tibetanus (Putorius), 163.
tickelli (Nycticejus), 317.
tickelli (Vesperugo), 317.
Tiger, 58, 601.
tigris (Felis), 58, 601.
timidus (Lepus), 450.
timoriensis (Nyctophilus), 299.
Toddy-Cat, 108.
torquata (Felis), 84, 85.

torquatus (Chiromeles), 353.
torquatus (Ursus), 197.
toufæus (Martes), 160.
tragatus (Nyctinomus), 353.
tragatus (Rhinolophus), 279.
tragocamelus (Antilope), 517.
tragocamelus (Boselaphus), 517.
tragocamelus (Portax), 518.
Tragomma, 525.
Tragops, 525.
Tragulidæ, 554.
Tragulina, 554.
Tragulus, 554.
travancorensis (Crocidura), 241.
Tree-Shrews, 208.
Triænops, 280.
Trichys, 447.
tridens (Hipposiderus), 282.
tridens (Phyllorhina), 282.
tridens, var. murraiana (Phyllorhina), 282.
trifida (Phyllorhina), 290.
trifoliatus (Rhinolophus), 272.
Trilatitus, 328.
trilineatus (Sciurus), 385.
tristriatus (Sciurus), 384.
trivirgata (Arctogale), 115.
trivirgata (Paguma), 115.
tubinaris (Harpyiocephalus), 324.
tulliana (Felis), 72.
Tupaia, 208.
Tupaiidæ, 207.
turnbulli (Sciuroptera), 367.
tursio (Delphinus), 581.
tursio (Tursiops), 581.
Tursiops, 581.
Tylonycteris pachypus, 307.
Tylopoda, 558.
tylopus (Vesperugo), 602.
typus (Paradoxurus), 106.
tytleri (Lepus), 450.
tytleri (Mus), 413.
tytleri (Sorex), 234.
tytlerii (Paradoxurus), 112.

uncia (Felis), 71.
undata (Felis), 78.
undulata (Viverra), 96.
Ungulata, 460.
Ungulata vera, 467.
unicolor (Cervus), 543.
unicornis (Rhinoceros), 472.
urbanus (Mus), 413.
Urial, 497.
Urotragus, 516.
Ursidæ, 192.
ursinus (Melursus), 201.
ursinus (Presbytis), 36.
ursinus (Semnopithecus), 36.
Ursitaxus, 175.
Ursus, 193.
Urva, 119.
urva (Gulo), 129.
urva (Herpestes), 129.

vaginalis (Cervulus), 532.
vaginalis (Cervus), 532.
Vandeleuria, 402.
variabilis (Lepus), 453.
velox (Delphinus), 588.
Vespertilio, 328.
Vespertilionidæ, 295.
Vesperugo, 300.
Vesperus, 302.
vestitus (Rhizomys), 440.
veter (Silenus), 16.
veter (Simia), 35.
vetulus (Cercopithecus), 34.
viculorum (Mus), 413.
vignei (Caprovis), 497.
vignei (Ovis), 497.
villosus (Sciuropterus), 369.
viridescens (Sorex), 234.
vitticollis (Herpestes), 128.
vitticollis (Mangusta), 128.
Viverra, 95.
viverriceps (Felis), 76.
Viverricula, 100.
Viverridæ, 94.
viverrina (Felis), 76.
Viverrinæ, 95.
volans (Galeopithecus), 249.
volans (Lemur), 249.
Voles, 429.
vulgaris (Hipposiderus), 288.
vulgaris (Lutra), 182, 601.
Vulpes, 147.
vulpes (Canis), 153.
vulpes indicus (Canis), 148.
vulpes montana (Canis), 153.

wagati (Felis), 78.
waldemarii (Crocidura), 236.
wallichii (Cervus), 535.
warryato (Capra), 511.
Water-Shrews, 245.
watsoni (Pelomys), 427.
Weasels, 166.
Whale, Indian Pilot, 577.
Whales, 565.
Whales, Ca'ing, 577.
Wolf, 135.
wynnei (Arvicola), 431.
wynnei (Microtus), 431.

Xantharpyia, 261.
xanthopygus (Cervus), 538.

Yak, 490.
yunnanensis (Hystrix), 445.
yunnanensis (Mus), 406.
yunnanensis (Pteromys) 364.
yunnanensis (Rhinolophus), 273.

zeylanicus (Paradoxurus), 111.
zeylonensis (Hystrix, 442.
zeylonensis (Paradoxurus), 112, 601.
zeylonensis (Sus), 560.
zibellina (Martes), 161.
zibetha (Viverra), 96.
Ziphiinæ, 570.

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INCLUDING

CEYLON AND BURMA.

Published under the authority of the Secretary of State for India in Council.

EDITED BY W. T. BLANFORD.

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BY

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PREFACE.

The first part of this volume, containing the Introduction, Primates, Carnivora, and Insectivora, was published at the end of June 1888. The delay of more than three years in completing the work has been caused by the necessity of devoting a large portion of my time to the editing of the five volumes belonging to the same series that have appeared since the first part of the present work was issued.

The Mammalia of British India, inclusive of Ceylon and Burma, here enumerated and described, just exceed 400 in number. Jerdon's 'Mammals of India,' published in 1867, contained descriptions of 242 species; but the area as now defined considerably exceeds the limits adopted by Jerdon, who excluded from his work all forms peculiar to Ceylon or Burma, and to all countries north of the main Himalayan range, west of the Indus, or east of the Bay of Bengal and of a line drawn northwards from the head of it. The greatest advance since Jerdon wrote, in our knowledge of Indian Mammals, has been in the orders of Chiroptera, Insectivora, and Rodentia, whilst the order with which, at the present time, our acquaintance is most imperfect is that of Cetacea.

In Sterndale's 'Natural History of the Mammalia of India and Ceylon,' published in 1884, the number of species is 482; but some of these are not found in British Territory, and

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several of the forms enumerated, now that better series of specimens have been collected, are no longer regarded as distinct.

Some acknowledgment of the assistance afforded to me in the preparation of the present work will be found in the Introduction. To the list of those who have aided in the publication should be added the Trustees of the Indian Museum, Calcutta, to whom I am indebted for the use of the cuts prepared for Dobson's 'Monograph of Asiatic Chiroptera,' and for the opportunity of comparing in London some specimens belonging to the Indian Museum. I must also express my particular obligation to Prof. W. H. Flower, Director of the Natural History Collection in the British Museum, for advice and information with regard to the Cetacea; to Mr. R. Lydekker for aid in preparing the account of the Ungulata; to Mr. W. L. Sclater for advance sheets of his Catalogue of Mammalia in the Indian Museum, and for notes on specimens in the Calcutta Collections; and to Mr. Oldfield Thomas, of the British Museum, for assistance and information of every kind, most freely afforded throughout the progress of the work, in connection with the Mammalian Collections under his supervision.

There is another acknowledgment that should perhaps have been made before, but for which the present affords a good occasion. If, as I hope, the present series of works is found useful by Indian naturalists, they will I am sure wish that the names of those who took the first steps in bringing the want of new Handbooks of Indian Zoology to the notice of the Government of India should not remain unrecorded.

The need for new and revised descriptive works had, for some years before 1881, been felt and discussed amongst naturalists in India, but the attention of the Government was, I believe, first called to the matter by a memorial dated Sept. 15th of that year, prepared by Mr. P. L. Sclater, the well-known Secretary of the Zoological Society, signed by

23 GSL

Mr. Charles Darwin, Sir J. Hooker, Professor Huxley, Sir J. Lubbock, Prof. W. H. Flower, and by Mr. Sclater himself, and presented to the Secretary of State for India. This memorial recommended the preparation of a series of Handbooks of Indian Zoology and my appointment as Editor. It is scarcely necessary to add that to the recommendation of men so highly respected and so well known in the world of Science the publication of the present 'Fauna of British India' is greatly due, and that Mr. Sclater is entitled to the thanks of all interested in the Zoology of India for the important part he took in the transaction. I can only express a hope that the present series as a whole may be worthy of the distinguished support to which, in so great a degree, it owes its origin.

With the publication of this part six out of the seven volumes in which it was originally proposed to describe the Vertebrata of British India have been completed. The remaining volume of Birds will be undertaken at once. I am glad to be able to announce that the 'Fauna of British India' will not be confined to Vertebrata, the preparation of three volumes on Moths by Mr. G. F. Hampson having been commenced.

W. T. BLANFORD.

November 30th, 1891.

SYSTEMATIC INDEX.

Class **MAMMALIA** 1

Subclass *EUTHERIA* 2

Order I. PRIMATES 3

Suborder Anthropoidea 3

Fam. Simiidæ 4

1. Hylobates, *Ill.* 5
    1. hoolock (*Harl.*) 5
    2. lar (*Linn.*) 7

Fam. Cercopithecidæ 10

Subfam. *Cercopithecinæ* 10

1. Macacus, *Lacép.* 11
    1. rhesus (*Audeb.*)...... 13
    2. assamensis, *McClell.*.. 15
    3. silenus (*Schreb.*) 16
    4. arctoides, *Is. Geoffr.*.. 17
    5. leoninus (*Blyth*) 18
    6. nemestrinus (*Linn.*) .. 20
    7. cynomolgus (*Schreb.*) . 21
    8. sinicus (*Linn.*) 23
    9. pileatus (*Shaw*)...... 24

Subfam. *Semnopithecinæ* 25

1. Semnopithecus, *F. Cuv.*.. 25
    1. entellus (*Dufr.*) 27
    2. schistaceus, *Hodgs.* .. 30
    3. priamus, *Elliot* 31
    4. hypoleucus, *Blyth*.... 33
    5. johni (*Fisch.*) 33
    6. cephalopterus (*Zimm.*) 34
    7. senex (*Erxl.*)........ 35
    8. ursinus (*Blyth*) 36
    9. pileatus, *Blyth* 37
    10. chrysogaster, *Licht.* .. 38
    11. barbei (*Blyth*) 39
    12. phayrei (*Blyth*)...... 39
    13. obscurus, *Reid* 41
    14. femoralis, *Horsf.* ... 42

Suborder Lemuroidea .. 43

Fam. Lemuridæ 43

1. Nycticebus, *Geoffr.*...... 44
    1. tardigradus (*Linn.*) .. 44
2. Loris, *Geoffr.* 47
    1. gracilis, *Geoffr.* 47

Order II. CARNIVORA .. 49

Suborder Fissipedia.... 50

Æluroidea 53

Fam. Felidæ.............. 53

1. Felis, *Linn.* 55
    1. leo, *Linn.* 56
    2. tigris, *Linn.* 58
    3. pardus, *Linn.*........ 67
    4. uncia, *Schreb.* 71
    5. nebulosa, *Griffith* 72
    6. marmorata, *Martin* .. 74
    7. temmincki, *Vig. & Horsf.*............ 75
    8. viverrina, *Benn.* 76
    9. bengalensis, *Kerr* 78

GSL

Page
10. rubiginosa, *Is. Geoffr.* .. 81
11. manul, *Pall.* 83
12. ornata, *Gray*........ 84
13. torquata, *F. Cuv.* 85
14. chaus, *Güld.* 86
15. caracal, *Güld.* 88
16. lynx, *Linn.* 89
2. Cynælurus, *Wagl.* 90
1. jubatus (*Schreb.*) 91

Fam. Viverridæ 94

Subfam. *Viverrinæ* 95

1. Viverra, *Linn.*.......... 95
1. zibetha, *Linn.* 96
2. civettina, *Blyth* 98
3. megaspila, *Blyth* 99
2. Viverricula, *Hodgs.* 100
1. malaccensis (*Gmel.*).. 100
3. Prionodon, *Horsf.* 102
1. pardicolor, *Hodgs.* .. 103
2. maculosus, *Blanf.*.... 104
4. Paradoxurus, *F. Cuv.* .. 105
1. niger (*Desm.*) 106
2. hermaphroditus (*Pall.*) 108
3. aureus, *F. Cuv.*...... 110
4. jerdoni, *Blanf.* 111
5. grayi, *Benn.* 112
5. Arctogale, *Pet.* 114
1. leucotis (*Blyth*) 115
6. Arctictis, *Temm.*........ 117
1. binturong (*Raffl.*).... 118

Subfam. *Herpestinæ* 119

1. Herpestes, *Ill.*.......... 119
1. auropunctatus (*Hodgs.*) 121
2. birmanicus, *Blanf.* .. 122
3. mungo (*Gmel.*) 123
4. smithi, *Gray* 126
5. fuscus, *Waterh.*...... 127
6. fulvescens, *Kelaart* .. 127
7. vitticollis, *Benn.* 128
8. urva (*Hodgs.*) 129

Fam. Hyænidæ 131

1. Hyæna, *Briss.*.......... 131
1. striata, *Zimm.* 132

Page
Cynoidea 134

Fam. Canidæ 134

1. Canis, *Linn.*.......... 135
1. lupus, *Linn.* 135
2. pallipes, *Sykes* 137
3. aureus, *Linn.*........ 140
2. Cyon, *Hodgs.* 142
1. dukhunensis (*Sykes*) .. 143
2. rutilans (*S. Müll.*) .. 147
3. Vulpes, *Briss.*.......... 147
1. bengalensis (*Shaw*) .. 148
2. cana, *Blanf.* 150
3. leucopus, *Blyth*...... 151
4. alopex (*Linn.*) 153
5. ferrilatus, *Hodgs.* 155

Arctoidea............... 156

Fam. Mustelidæ.......... 156

Subfam. *Mustelinæ* 157

1. Mustela, *Linn.* 157
1. flavigula, *Bodd.*...... 158
2. foina, *Erxl.* 159
2. Putorius, *Cuv.*.......... 162
1. larvatus, *Hodgs.* 163
2. sarmaticus (*Pall.*).... 164
3. erminea (*Linn.*) 165
4. subhemachalanus (*Hodgs.*).......... 166
5. canigula (*Hodgs.*).... 167
6. alpinus (*Gebl.*) 168
7. cathia (*Hodgs.*)...... 169
8. strigidorsus (*Hodgs.*) . 170

Subfam. *Melinæ*............ 172

1. Helictis, *Gray*......... 172
1. orientalis (*Horsf.*) .. 173
2. personata (*Geoff.*) 174
2. Mellivora, *Storr* 175
1. indica (*Kerr*)........ 176
3. Arctonyx, *F. Cuv.* 178
1. collaris, *F. Cuv.* 178
2. taxoides, *Blyth* 180

Subfam. *Lutrinæ* 181

1. Lutra, *Erxl.*........... 181
1. vulgaris, *Erxl.* 182

L5
GSL

Page
2. ellioti, *Anders.* 185
3. aureobrunnea, *Hodgs.* 186
4. leptonyx, *Horsf.* 187

Fam. Procyonidæ 189

1. Ælurus, *F. Cuv.* 189
1. fulgens, *F. Cuv.* 190

Fam. Ursidæ 192

1. Ursus, *Linn.* 193
1. arctus, *Linn.* 194
2. torquatus, *Wagn.* 197
3. malayanus, *Raffl.* 199
2. Melursus, *Meyer* 200
1. ursinus (*Shaw*) 201

Order III. INSECTIVORA. 206

Suborder Insectivora vera 207

Fam. Tupaiidæ 207

1. Tupaia, *Raffl.* 208
1. ellioti, *Waterh.* 209
2. ferruginea, *Raffl.* 210
3. nicobarica (*Zel.*) 212

Fam. Erinaceidæ 212

Subfam. *Erinaceinæ* 213

1. Erinaceus, *Linn.* 213
1. collaris, *Gray & Hardw.* 215
2. megalotis, *Blyth* 216
3. jerdoni, *Anders.* 216
4. pictus, *Stol.* 217
5. micropus, *Blyth* 218

Subfam. *Gymnurinæ* 219

1. Gymnura, *Horsf. & Vig.* 219
1. rafflesi, *Horsf. & Vig.* 220
2. suilla (*Müll. & Schleg.*) 221

Fam. Talpidæ 222

1. Talpa, *Linn.* 223
1. europæa, *Linn.* 224
2. micrura, *Hodgs.* 225
3. leucura, *Blyth* 226

Fam. Soricidæ 227

1. Soriculus, *Blyth* 228
1. nigrescens (*Gray*).... 229
2. caudatus (*Hodgs.*).... 230
3. macrurus (*Hodgs.*) .. 231
2. Crocidura *Wagl.* 231
1. murina (*Linn.*) 233
2. cærulea (*Kerr*) 236
3. macropus (*Blyth*).... 237
4. bidiana, *Anders.* 238
5. rubicunda, *Anders.* .. 239
6. leucogenys, *Dobs.* 239
7. dayi, *Dobs.* 240
8. hodgsoni (*Blyth*) 240
9. perrotteti (*Duvern.*).. 241
10. fuliginosa (*Blyth*).... 242
11. horsfieldi (*Tomes*).... 242
12. fumigata (*De Fil.*) .. 243
13. aranea (*Linn.*) 243
3. Anurosorex, *A. M.-Edw.* .. 244
1. assamensis, *Anders.* .. 244
4. Chimarrogale, *Anders.* .. 245
1. himalayica (*Gray*) .. 245
5. Nectogale, *A. M.-Edw.* .. 246
1. elegans, *A. M.-Edw.* .. 247

Suborder Dermoptera . 248

Fam. Galeopithecidæ 248

1. Galeopithecus, *Pall.* 248
1. volans (*Linn.*) 249

Order IV. CHIROPTERA .. 251

Suborder Megachiroptera 255

Fam. Pteropodidæ 255

1. Pteropus, *Briss.* 255
1. medius, *Temm.* 257
2. edulis, *Geoff.* 259
3. nicobaricus, *Fitz.* 260
2. Xantharpyia, *Gray* 261
1. amplexicaudata (*Geoff.*) 261

GSL

Page
3. Cynopterus, *Cuv.* 262
1. marginatus (*Geoff.*) .. 263
2. brachyotus, *Müll.* 264
3. scherzeri (*Fitz.*) 264
4. brachysoma, *Dobs.* ... 264
5. blanfordi, *Thom.* 265
4. Carponycteris, *Lydek.* .. 265
1. minima (*Geoff.*) 265
5. Eonycteris, *Dobs.* 266
1. spelæa (*Dobs.*) 266

Suborder MICROCHIROPTERA 267

Fam. RHINOLOPHIDÆ 267

Subfam. *Rhinolophinæ* 268

1. Rhinolophus, *Desm.* 268
1. luctus, *Temm.* 270
2. cœlophyllus, *Pet.* 272
3. trifoliatus, *Temm.* 272
4. mitratus, *Blyth* 273
5. pearsoni, *Horsf.* 273
6. affinis, *Horsf.* 274
7. andamanensis, *Dobs.* .. 275
8. petersi, *Dobs.* 275
9. macrotis, *Hodgs.* 276
10. minor, *Horsf.* 276
11. hipposiderus (*Bechst.*) 277
12. ferrum-equinum (*Schreb.*) 278
13. tragatus, *Hodgs.* 279

Subfam. *Hipposiderinæ* 280

1. Hipposiderus, *Gray* 281
1. tridens (*Geoff.*) 282
2. armiger (*Hodgs.*) 283
3. leptophyllum (*Dobs.*) 284
4. diadema (*Geoff.*) 284
5. nicobarensis (*Dobs.*) .. 286
6. galeritus, *Cantor* 287
7. speoris (*Schn.*) 287
8. larvatus (*Horsf.*) ... 288
9. bicolor (*Temm.*) 289
10. amboinensis (*Pet.*) .. 290
2. Cœlops, *Blyth* 290
1. frithi, *Blyth* 291

Fam. NYCTERIDÆ 292

1. Megaderma, *Geoff.* 292
1. lyra, *Geoff.* 293
2. spasma (*Linn.*) 294

Page
Fam. VESPERTILIONIDÆ 295

1. Plecotus, *Geoff.* 297
1. auritus (*Linn.*) 297
2. Synotus, *Keys. & Blas.* .. 298
1. darjelingensis (*Hodgs.*) 298
3. Otonycteris, *Pet.* 299
1. hemprichi, *Pet.* 300
4. Vesperugo, *Keys. & Blas.* 300
1. serotinus (*Schreb.*) .. 303
2. nasutus, *Dobs.* 304
3. borealis (*Nilss.*) 305
4. discolor (*Natt.*) 305
5. atratus (*Blyth*) 306
6. pachyotis, *Dobs.* 307
7. pachypus (*Temm.*) .. 307
8. noctula (*Schreb.*) 308
9. leisleri (*Kuhl*) 309
10. mordax, *Pet.* 310
11. affinis (*Dobs.*) 311
12. circumdatus (*Temm.*). 312
13. ceylonicus (*Kelaart*).. 312
14. abramus (*Temm.*).... 313
15. pipistrellus (*Schreb.*).. 314
16. kuhli (*Natt.*) 315
17. annectens (*Dobs.*) 316
17 *a.* tylopus, *Dobs.* 602
18. tickelli (*Blyth*) 317
19. blanfordi, *Dobs.* 317
5. Nycticejus, *Rafin.* 318
1. dormeri (*Dobs.*) 319
2. kuhli (*Leach*) 320
3. emarginatus, *Dobs.* .. 321
4. pallidus (*Dobs.*)...... 322
5. ornatus, *Blyth* 322
6. Harpyiocephalus, *Gray* .. 323
1. tubinaris, *Scully* 324
1 *a.* auratus, *A. M.-Edw.* 602
1 *b.* feæ, *Thom.* 602
2. griseus (*Hutton*) 325
3. harpyia (*Temm.*) 325
4. cyclotis (*Dobs.*)...... 326
5. leucogaster (*A. M.-Edw.*) 327
7. Vespertilio, *Linn.* 328
1. hasselti, *Temm.* 330
2. longipes, *Dobs.* 331
3. daubentoni, *Leisl.* 331
4. megalopus, *Dobs.* 332
5. nipalensis, *Dobs.* 333
6. murinus, *Linn.* 334
7. dobsoni, *Trouessart* .. 335
8. formosus, *Hodgs.* 335
9. mystacinus, *Leisl.* 336
10. muricola, *Hodgs.* 337

GL

Page
8. Cerivoula, *Gray* 338
1. picta (*Pall.*) 339
2. hardwickii (*Horsf.*) . . 340
3. papillosa (*Temm.*). . . . 341
9. Miniopterus, *Bon.* 341
1. schreibersi (*Kuhl*). . . 342

Fam. EMBALLONURIDÆ 343

Subfam. *Emballonurinæ* 344

1. Emballonura, *Temm.*. . . . 344
1. semicaudata (*Peale*). . 345
2. Taphozous, *Geoff.* 345
1. melanopogon, *Temm.* . 347
2. theobaldi, *Dobs.* 348
3. longimanus, *Hardw.*. . 348
4. cachhensis, *Dobs.* . . . 349
5. saccolæmus, *Temm.* . . 350
3. Rhinopoma, *Geoff.* 350
1. microphyllum, *Geoff.* . 351

Subfam. *Molossinæ* 352

1. Nyctinomus, *Geoff.* 353
1. tragatus, *Dobs.* 353
2. plicatus (*Buch.*) 354

Order V. RODENTIA. 356

Suborder SIMPLICIDENTATA. 357

Fam. SCIURIDÆ. 358

Subfam. *Sciurinæ* 359

1. Eupetaurus, *Thom.* 359
1. cinereus, *Thom.* 359
2. Pteromys, *Cuv.* 360
1. oral, *Tick.* 361
2. inornatus, *Geoff.* 363
3. magnificus (*Hodgs.*). . 364
4. yunnanensis, *Anders.* . 364
5. caniceps (*Gray*) 365
6. punctatus, *Gray* 365
3. Sciuropterus, *F. Cuv.* 366
1. fimbriatus, *Gray* 366
2. alboniger, *Hodgs.* 367
3. sagitta (*Linn.*) 367
4. spadiceus, *Blyth* 368
5. fuscicapillus, *Jerdon* . . 368
6. pearsoni, *Gray* 369
4. Sciurus, *Linn.* 369
1. indicus, *Erxl.* 371
2. bicolor, *Sparrm.* 373
3. macrurus, *Penn.* 374
4. ferrugineus, *F. Cuv.* . . 375
5. locria, *Hodgs.* 376
6. rufigenis, *Blanf.* 376
7. erythræus, *Pall.* 377
8. quinquestriatus, *Anders.* 378
9. phayrei, *Blyth* 379
10. pygerythrus, *Geoff.* . . 379
11. caniceps, *Gray* 380
12. griseimanus, *A. M.-Edw.* 381
13. locroides, *Hodgs.* 381
14. atridorsalis, *Gray* 382
15. palmarum, *Linn.* 383
16. tristriatus, *Waterh.* . . 384
17. layardi, *Blyth* 385
18. sublineatus, *Waterh.* . 385
19. macclellandi, *Horsf.*. . 386
20. berdmorei, *Blyth* 387

Subfam. *Arctomyinæ*. 388

1. Arctomys, *Schreb.* 388
1. himalayanus, *Hodgs.* . 388
2. hodgsoni, *Blanf.* 389
3. caudatus, *Jacquem.* . . 390

Fam. DIPODIDÆ. 391

1. Alactaga, *Cuv.* 391
1. indica, *Gray* 392

Fam. MURIDÆ 393

Subfam. *Platacanthomyinæ* . . 394

1. Platacanthomys, *Blyth* . . 394
1. lasiurus, *Blyth* 394

Subfam. *Gerbillinæ* 396

1. Gerbillus, *Desm.*. 396
1. indicus (*Hardw.*) 396
2. hurrianæ, *Jerd.*. 398
3. erythrura, *Gray*. 399
4. nanus, *Blanf.*. 399
5. gleadowi, *Murr.* 400

CSL

Page
Subfam. *Murinæ* 400

1. Hapalomys, *Blyth* 401
    1. longicaudatus, *Blyth* . 401
2. Vandeleuria, *Gray* 402
    1. oleracea (*Benn.*) 402
3. Chiropodomys, *Pet.* 403
    1. gliroides (*Blyth*) 403
4. Mus, *Linn.* 404
    1. rattus, *Linn.* 406
        var. alexandrinus, *Geoff.* 407
        var. nitidus, *Hodgs.* .. 407
        var. rufescens, *Blyth* .. 407
    2. concolor, *Blyth* 408
    3. decumanus, *Pall.* 408
    4. fulvescens, *Gray* 409
    5. bowersi, *Anders.* 410
    6. berdmorei, *Blyth* 410
    7. blanfordi, *Thom.* 411
    8. jerdoni (*Blyth*) 411
    9. niveiventer, *Hodgs.* .. 412
    10. chiropus, *Thom.* 413
    11. musculus, *Linn.* 413
    12. bactrianus, *Blyth* 414
    13. sublimis, *Blanf.* 415
    14. nitidulus, *Blyth* 415
    15. arianus, *Blanf.* 416
    16. buduga (*Gray*) 416
    17. cervicolor, *Hodgs.* 417
    18. platythrix, *Benn.* 418
    19. mettada (*Gray*) 419
    20. gleadowi, *Murr.* 420
    21. erythrotis, *Blyth* 420
    22. humei, *Thom.* 421
5. Nesocia, *Gray* 421
    1. hardwickei (*Gray*) .. 422
    2. bengalensis (*Gray & Hardw.*) 423
    3. bandicota (*Bechst.*) .. 425
    4. nemorivaga (*Hodgs.*) . 426
6. Acomys, *Is. Geoff.* 426
    1. dimidiatus (*Rüpp.*) .. 426
7. Golunda, *Gray* 427
    1. ellioti, *Gray* 427

Subfam. *Cricetinæ* 428

1. Microtus, *Schrank* 429
    1. roylei (*Gray*) 430
    2. stoliczkanus (*Blanf.*) . 430
    3. stracheyi (*Thom.*).... 431
    4. wynnei (*Blanf.*) 431
    5. blanfordi (*Scully*) 432
    6. blythi (*Blanf.*) 432
    7. sikimensis (*Hodgs.*) .. 433
    8. melanogaster (*A. M.-Edw.*)...... 434
2. Ellobius, *Fisch.* 434
    1. fuscicapillus (*Blyth*) .. 435
3. Cricetus, *Cuv.* 436
    1. phæus (*Pall.*) 436
    2. fulvus, *Blanf.* 437
    3. isabellinus, *De Fil.* .. 437

Fam. SPALACIDÆ 437

1. Rhizomys, *Gray* 438
    1. badius, *Hodgs.* 438
    2. pruinosus, *Blyth* 439
    3. sumatrensis (*Raffl.*) .. 439

Fam. HYSTRICIDÆ 441

1. Hystrix, *Linn.* 441
    1. leucura, *Sykes* 442
    2. hodgsoni (*Gray*) 444
    3. bengalensis, *Blyth* 444
2. Atherura, *Cuv.* 445
    1. macrura (*Linn.*)...... 446

Suborder DUPLICIDENTATA 447

Fam. LEPORIDÆ 447

1. Lepus, *Linn.* 448
    1. nigricollis, *F. Cuv.* 449
    2. ruficaudatus, *Geoff.* .. 450
    3. dayanus, *Blanf.* 451
    4. peguensis, *Blyth* 451
    5. tibetanus, *Waterh.* .. 452
    6. oiostolus, *Hodgs.* 452
    7. hypsibius, *Blanf.* 453
    8. hispidus, *Pears.* 454

Fam. LAGOMYIDÆ 455

1. Lagomys, *Cuv.* 455
    1. roylei, *Ogil.* 456
    2. curzoniæ, *Hodgs.* 457
    3. macrotis, *Günth.* 457
    4. rufescens, *Gray* 458
    5. ladacensis, *Günth.* 458

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GSL

Page
Order VI. UNGULATA 460

SUBUNGULATA 462

Suborder PROBOSCIDEA . 462

Fam. ELEPHANTIDÆ 462

1. Elephas, *Linn.* 462
    1. maximus, *Linn.* 463

UNGULATA VERA 467

Suborder PERISSODACTYLA 467

Fam. EQUIDÆ 468

1. Equus, *Linn.* 468
    1. hemionus, *Pallas* ... 470

Fam. RHINOCEROTIDÆ...... 471

1. Rhinoceros, *Linn.* 471
    1. unicornis, *Linn.* 472
    2. sondaicus, *Cuv.* 474
    3. sumatrensis, *Cuv.* 476

Fam. TAPIRIDÆ 478

1. Tapirus, *Briss.* 478
    1. indicus, *Cuv.* 478

Suborder ARTIODACTYLA 479

Pecora 481

Fam. BOVIDÆ 482

1. Bos, *Linn.* 483
    1. gaurus, *Ham. Smith* .. 484
    2. frontalis, *Lambert* 487
    3. sondaicus, *Müll. & Schl.* 489
    4. grunniens, *Linn.* 490
    5. bubalus, *Linn.* 491
2. Ovis, *Linn.* 493
    1. hodgsoni, *Blyth* 494
    2. poli, *Blyth* 496
    3. vignei, *Blyth* 497
    4. nahura, *Hodgs.* 499

Page
3. Capra, *Linn.* 501
    1. ægagrus, *Gmel.* 502
    2. sibirica, *Mey.* 503
    3. falconeri (*Hügel*) 505
4. Hemitragus, *Hodgs.* 508
    1. jemlaicus (*Ham. Sm.*) 509
    2. hylocrius (*Ogilb.*) 511
5. Nemorhædus, *Ham. Sm.* . 512
    1. bubalinus (*Hodgs.*) .. 513
    2. sumatrensis (*Shaw*) .. 514
6. Cemas, *Ogilby* 516
    1. goral (*Hardw.*) 516
7. Boselaphus, *Blainv.* 517
    1. tragocamelus (*Pall.*) .. 517
8. Tetracerus, *Leach* 519
    1. quadricornis (*Blainv.*) 519
9. Antilope, *Pall.* 521
    1. cervicapra (*Linn.*).... 521
10. Pantholops, *Hodgs.* 524
    1. hodgsoni (*Abel*) 524
11. Gazella, *Blainv.* 525
    1. bennetti (*Sykes*) 526
    2. subgutturosa (*Güld.*) . 528
    3. picticaudata (*Hodgs.*) . 529

Fam. CERVIDÆ 530

Subfam. *Cervinæ* 531

1. Cervulus, *Blainv.* 531
    1. muntjac (*Zimm.*) 532
    2. feæ, *Thom. & Dor.* .. 534
2. Cervus, *Linn.* 534
    1. cashmirianus, *Falc.* .. 535
    2. duvauceli, *Cuv.* 538
    3. eldi, *Guthrie* 541
    4. unicolor, *Bechst.* 543
    5. axis, *Erxl.* 546
    6. porcinus, *Zimm.* 549

Subfam. *Moschinæ* 551

1. Moschus, *Linn.* 551
    1. moschiferus, *Linn.* .. 552

Tragulina 554

Fam. TRAGULIDÆ.......... 554

1. Tragulus, *Briss.* 554
    1. meminna (*Erxl.*) 555
    2. javanicus (*Gmel.*).... 556
    3. napu (*F. Cuv.*) 557

CSL-AS-54(R)
AS001824
599.0954 BLA-F

GSL

Page
Tylopoda 558

Suina 559

Fam. SUIDÆ 559

1. Sus, *Linn.* 559
    1. cristatus, *Wagn.* 560
    2. andamanensis, *Blyth* . . 562
    3. salvanius (*Hodgs.*) . . 563

Order VII. CETACEA 564

Suborder MYSTACOCŒTI 565

Fam. BALÆNIDÆ 565

1. Balænoptera, *Lacép.* 566
    1. indica, *Blyth* 567
    2. edeni, *Anders.* 568

Suborder ODONTOCŒTI . . 569

Fam. PHYSETERIDÆ 570

1. Physeter, *Linn.* 570
    1. macrocephalus, *Linn.* . . 571
2. Cogia, *Gray* 572
    1. breviceps (*Blainv.*) . . 572

Fam. DELPHINIDÆ 573

1. Phocæna, *Cuv.* 574
    1. phocænoides (*Cuv.*) . . 574
2. Orca, *Wagl.* 576
    1. ? gladiator (*Linn.*) . . 576
3. Globicephalus, *Less.* 577
    1. indicus, *Blyth* 577
4. Orcella, *Gray* 578
    1. brevirostris (*Ow.*) 578
    2. fluminalis, *Anders.* . . 579
5. Lagenorhynchus, *Gray* . . 579
    1. electra, *Gray* 580
    2. obscurum (*Gray*) 580
6. Tursiops, *Gerv.* 581
    1. tursio (*Fabr.*) 581
7. Steno, *Gray* 582
    1. frontatus (*Cuv.*) 582
    2. plumbeus (*Duss.*) 583
    3. perniger (*Elliot*) 583
    4. lentiginosus (*Ow.*) . . 584
    5. maculiventer (*Ow.*) . . 585
8. Delphinus, *Linn.* 586
    1. delphis, *Linn.* 587
    2. dussumieri, *Blanf.* . . 588
    3. malayanus, *Less.* 588

Fam. PLATANISTIDÆ 589

1. Platanista, *Wagl.* 589
    1. gangetica (*Lebeck*) . . 590

Order VIII. SIRENIA . . . 592

Fam. MANATIDÆ 592

1. Halicore, *Ill.* 593
    1. dugong (*Erxl.*) 594

Order IX. EDENTATA 595

Suborder SQUAMATA 595

Fam. MANIDÆ 595

1. Manis, *Linn.* 595
    1. pentadactyla, *Linn.* . . 597
    2. aurita, *Hodgs.* 599
    3. javanica, *Desm.* 599

ERRATUM.

Fig. 132, p. 418, has by mistake been printed upside down, and consequently *a* represents the teeth of the lower jaw, *b* of the upper, the anterior extremity below, instead of above as in other figures.

334
Tumpa
334

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